DRAFT Version 2 Demand and Supply Assessment

January

2011

This Assessment is a compilation and study of historical water demand and supply characteristics for the Prescott AMA from the year 1985 through 2006. In addition, the Assessment calculates seven water supply and demand projection scenarios to the year 2025.

Prescott Active Management Area

DRAFT
Demand and Supply Assessment
1985-2025
Prescott Active Management Area

January 2011

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Special thanks to the following people who donated their time and advice:

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EXECUTIVE SUMMARY

The *Water Demand and Supply Assessment 1985-2025, Prescott Active Management Area* (Assessment) is a compilation and study of historical water demand and supply characteristics for the Prescott Active Management Area (AMA) for the years 1985-2006. In addition, the Assessment calculates seven water supply and demand projection scenarios to the year 2025. The Arizona Department of Water Resources (ADWR) conducted the Assessment as preparation for the *Fourth Management Plan for Prescott Active Management Area* as required by the *1980 Groundwater Management Code* (Code).

The statutory management goals established for each of the five AMAs are the foundation for the implementation of the groundwater management programs established by the Code. The statutory management goal of the Prescott AMA is to attain safe-yield, on an AMA-wide basis, by the year 2025. Safe-yield is a balance between the amount of groundwater pumped from the AMA annually, and the amount of water naturally or artificially recharged. Groundwater withdrawals in excess of natural and artificial recharge leads to an overdraft of the groundwater supply in the AMA basin. The Code identified management strategies which relied, in part, on continuing mandatory conservation by all major water using sectors to reduce total groundwater withdrawals in the AMAs, identified in the Management Plan for the AMA, and on increasing the use of renewable water supplies in place of groundwater supplies. Five management periods were identified for the development of Management Plans which were to assist in moving the AMA closer to its management goal by 2025.

A review of historical annual water demand, supply and overdraft in the Prescott AMA from 1985 to 2000 shows that the volume of groundwater overdraft fluctuated on an annual basis, but generally increased over time with fifteen of the sixteen years exhibiting overdraft. High precipitation years will result in single year non-overdraft conditions in the AMA. The severity of the overdraft situation in the Prescott AMA ultimately resulted in ADWR issuing a final determination on January 12, 1999 that the AMA was no longer in safe-yield.

The three baseline scenarios for future water use in this Assessment indicate that without additional reductions in groundwater pumping, increased demands and a lack of sustainable growth patterns combined with a variable surface water supply may result in continued groundwater overdraft in the Prescott AMA in the future. Three additional shortage scenarios examine the effects of a possible surface water shortage due to possible climate effects for several years before 2025, which could exacerbate groundwater overdraft. However, a seventh scenario demonstrates that the use of imported groundwater could result in a positive turn in enabling the AMA to reduce overdraft to a significant degree by 2025.

The purpose of this Assessment is to identify the success through 2006 with achievement of the Prescott AMA management goal. Additionally, by developing future projections, ADWR can analyze different supply and demand mechanisms that may affect the AMA's ability to achieve safe-yield by 2025. While ADWR recognizes these future projections are not exact representations of what will occur in the future, they do identify a range of possibilities that provide valuable information that benefits decisions regarding water management in the Prescott AMA. Most importantly, the information in this Assessment will be used to assist ADWR in working with the local communities to develop management strategies to assist the AMA in moving even closer to safe-yield by the end of the Fourth Management Plan.

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LIST OF ACRONYMS AND ABBREVIATIONS

annual report	Annual Groundwater Withdrawal and Use Report
ACC	Arizona Corporation Commission
ADWR	Arizona Department of Water Resources
AMA	Active Management Area
ASLD	Arizona State Land Department
AWS	Assured Water Supply
BMP	best management practices
CAP	Central Arizona Project
CAWS	Certificate of Assured Water Supply
City	City of Prescott
Code	Groundwater Code
CVID	Chino Valley Irrigation District
DAWS	Designation of Assured Water Supply
GPCD	gallons per capita per day
GSF	Groundwater Savings Facility
IGFR	Irrigation Grandfathered Right
LTSC	Long-term Storage Credits
USF	Underground Storage Facility
WWTF	Wastewater Treatment Facility
YPIT	Yavapai-Prescott Indian Tribe

PART I INTRODUCTION TO THE ASSESSMENT

1. INTRODUCTION

1.1 Purpose of the Prescott Active Management Area Assessment

The *Water Demand and Supply Assessment 1985-2025, Prescott Active Management Area* (Assessment) is a compilation and study of historical water demand and supply characteristics from 1985 to 2006 for the two groundwater sub-basins that comprise the AMA. It reviews past conditions and makes projections to the year 2025 using seven scenarios. The Arizona Department of Water Resources (ADWR) conducted this Assessment as preparation for the planning and public interaction that will precede the drafting of the *Fourth Management Plan for Prescott Active Management Area* (4MP) as required by the *1980 Groundwater Management Code* (Code). For more information regarding the Code, management plans, ADWR's mission and the governmental and institutional setting for this Active Management Area (AMA), refer to the *Third Management Plan for Prescott Active Management Area 2000 – 2010* (3MP).

This document is divided into five parts, as described below:

- The Introduction, which provides a general overview of the Prescott AMA, the statutory management goal, and the Assured Water Supply requirements;
- The Budget Components and Calculation of Overdraft, which defines the major components of the water budget used in this Assessment and how overdraft is calculated;
- The Historical Water Demand and Overdraft for each water use sector (Municipal, Industrial, and Agricultural);
- The Projected Demand and Overdraft by using assumptions formulated by ADWR based on historical use, population projected by DES, and others; and
- The Fourth Management Plan process that will follow this Assessment.

1.2 General Overview of the Prescott Active Management Area

Five AMAs (Phoenix, Pinal, Prescott, Santa Cruz and Tucson) have been designated as requiring specific, mandatory management practices to preserve and protect groundwater supplies for the future (See Figure 1-1). The Prescott AMA is 485 square miles in area and was established in 1980 upon enactment of the Code. Since the 1970's, water users in the Prescott AMA have depended almost solely on groundwater as a source of supply due to the limited and unreliable nature of surface water supplies in the AMA. The direct delivery and storage of reclaimed water began in the mid-1990's and has increased over time, somewhat reducing the reliance on groundwater supplies. For a detailed overview of the geography, hydrology, climate, and environmental conditions in the Prescott AMA, refer to the *Draft Arizona Water Atlas, Volume 8, Active Management Area Planning Area* (ADWR, 2010).

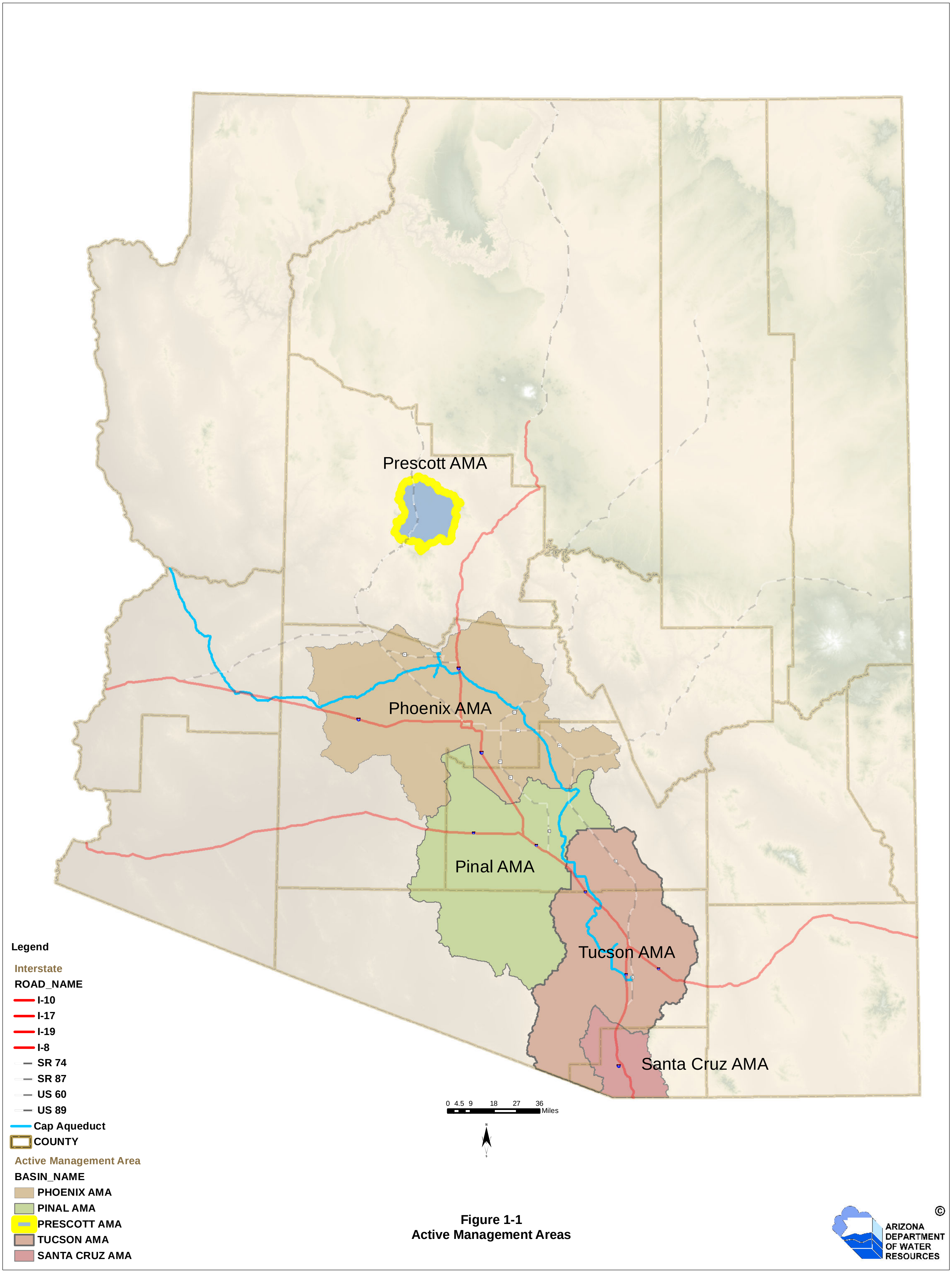


Figure 1-1
Active Management Areas

1.3 The Management Goal of the Prescott AMA

The Code established management goals for each of the AMAs, focused primarily on the reduction of groundwater dependence. The statutory management goal of the Prescott AMA is to achieve safe-yield by 2025 and maintain it thereafter. Safe-yield means that the amount of groundwater pumped from the AMA on an average annual basis does not exceed the amount of water that is naturally or artificially recharged. Safe-yield is a basin-wide balance; water level declines in one portion of the AMA could be offset by reducing groundwater pumping or recharging water in another part of the AMA. The safe-yield goal was established as part of the Code, and is intended to guide the water management strategies to address the long-term implications of groundwater overdraft.

1.4 Groundwater Management in the AMAs

To address groundwater depletion in the state's most populous areas, the state legislature created the Code in 1980 and created ADWR to implement it. The goal of the Code is twofold: 1) to control severe groundwater depletion; and 2) to provide the means for allocating Arizona's limited groundwater resources to most effectively meet the state's changing water needs. This effort to manage Arizona's groundwater resources was so progressive that in 1986 the Code was named one of the ten most innovative programs in state and local government by the Ford Foundation and Harvard University. When granting the award, it was noted that no other state had attempted to manage its water resources so comprehensively. Accordingly, Arizona built consensus around its policy and then followed through to make it work in practice.

Areas where groundwater depletion is most severe are designated as AMAs. There are five AMAs. These areas are subject to regulation pursuant to the Code. Each AMA has a statutory management goal. In the Phoenix, Prescott, and Tucson AMAs, the primary management goal is to achieve safe-yield by the year 2025. In the Pinal AMA, where the economy is primarily agricultural, the management goal is to preserve that economy for as long as feasible, while considering the need to preserve groundwater for future non-irrigation uses. Recognizing that the Santa Cruz AMA is currently at the safe-yield status, the goal of the Santa Cruz AMA is to maintain safe-yield and prevent local water tables from experiencing a long-term decline. Each AMA carries out its programs in a manner consistent with these goals while considering and incorporating the unique character of each AMA and its water users.

Since groundwater use in AMAs is regulated, withdrawal of groundwater in these AMAs requires a permit from ADWR. On most of these wells, state law assesses withdrawal fees and requires annual groundwater withdrawal and use reports to be filed.

In order to withdraw and use groundwater, an individual must complete the following steps:
1. Obtain a groundwater withdrawal authority;
2. Obtain a well permit and employ a licensed well driller:
3. Measure and report annual groundwater withdrawals; and
4. Meet conservation program requirements under the AMA Management Plans.

The following groundwater withdrawal authorities are used to allocate groundwater resources and to limit demand for groundwater in the AMAs.

<u>Irrigation Grandfathered Rights</u>
Within AMAs, anyone who owns land that was legally irrigated with groundwater at any time from January 1, 1975, to January 1, 1980 and has been issued a Certificate of Irrigation Grandfathered Right (IGFR) by ADWR has the right to use groundwater for the irrigation of that

land. The term irrigation is limited to the growing of crops for sale, human consumption or livestock feeding on two or more acres.

Type 1 and Type 2 Non-Irrigation Grandfathered Rights

A Type 1 non-irrigation grandfathered right (Type 1 right) is associated with land permanently retired from farming and converted to a non-irrigation use. This right, like an irrigation grandfathered right, may be sold or leased only with the land. The maximum amount of groundwater that may be pumped each year using a Type 1 right is three acre-feet per acre.

Groundwater withdrawn pursuant to a Type 2 non-irrigation grandfathered right (Type 2 right) can generally be used for any non-irrigation use from a non-exempt well (pumping capacity of greater than 35 gallons per minute) and equals the maximum amount pumped in any one year between 1975 and 1980. Type 2 rights can be sold separately from the land or well. These rights are most often used for industrial purposes such as sand and gravel facilities, golf courses and dairies. Type 1 and Type 2 right holders are generally required to comply with the conservation requirements associated with the Industrial Conservation Programs in the Management Plans.

Service Area Rights

Service area rights allow cities, towns, private water companies and irrigation districts to withdraw and transport groundwater to serve their customers within their service area. Most persons within an AMA receive water through service area rights. Entities with service area rights must comply with the Municipal Conservation Program requirements in the Management Plans.

Groundwater Withdrawal Permits

Groundwater withdrawal permits allow new withdrawals of groundwater for non-irrigation uses. Currently, seven types of withdrawal permits are allowed under the Code. A General Industrial Use Permit (GIU), the most commonly used type of permit, allows the withdrawal or groundwater for industrial uses outside the service areas of a city, town or private water company. Generally, users of these permits are required to comply with the Industrial Conservation Program requirements in the Management Plans.

Wells

Two types of applications for well drilling authority exist. A Notice of Intent (NOI) to Drill is required to be filed with ADWR for all wells which are to be drilled outside the AMAs and exempt wells which will be located inside an AMA. Exempt wells are typically small domestic wells, pumping not more than 35 gallons per minute. Under the Code, exempt wells are not required to meter or report water use and are not regulated by ADWR, other than being required to file an NOI. For non-exempt wells within an AMA, an application for a Drilling Permit is required.

Water Measurement, Groundwater Withdrawal Fees and Reporting Requirements

Groundwater withdrawn from non-exempt wells must be measured using an approved measuring device or method. In addition, all groundwater withdrawn from non-exempt wells is subjected to an annual groundwater withdrawal fee. Fees collected for augmentation, conservation assistance, and monitoring and assessing water availability are used to finance the augmentation and conservation assistance programs that are part of the Management Plans for AMAs.

Annual water withdrawal and use reports are required to be filed for most groundwater withdrawn within an AMA. Accurate records of the right holder’s withdrawals, transportation, delivery and use of groundwater must be kept by the right holder and reported to ADWR on a yearly basis.

Management Plans and Conservation Requirements

Management Plans reflect the evolution of the Code, assisting in moving Arizona toward its long-term water management goals. Management Plans are required from each AMA for five sequential management periods extending from 1980 through 2025. The First Management Plan (1MP) applied from 1985-1990. The Second Management Plan (2MP) was in effect until 2000, and the Third Management Plan (3MP) from 2001 until 2010. ADWR is in the initial stages of formulating the Fourth Management Plan (4MP), through the development of this Assessment, scheduled for release in 2010. The provisions of the 4MP will be in effect from 2010 through 2020. A Fifth Management Plan (5MP) will be developed for the years 2020 through 2025.

Most entities withdrawing groundwater from a non-exempt well are required, pursuant to the Management Plan, to participate in one of the following: the Agricultural Conservation Program, the Municipal Conservation Program or the Industrial Conservation Program.

Holders of an IGFR who withdraw water from a non-exempt well are subject to the Agricultural Conservation Program, which determines conservation requirements based on water duties and maximum annual groundwater allotments or through Best Management Practices (BMP). A key component of the Code prohibits the establishment of new IGFRs – eliminating new acres from being put into agricultural production.

Under the Municipal Conservation Program, municipal water providers are required to meet conservation requirements based on reductions in total per capita use or through implementation of BMPs. Additionally, municipal providers are required to limit the amount of lost and unaccounted for water in their delivery system.

All Type 1 and Type 2 right holders and some GIU permit holders are subject to the Industrial Conservation Program. Conservation requirements are based on the best available technology for the end use and range, based on the permit or right type, from BMPs to specific groundwater allotments for water users such as turf-facilities.

Compliance and Enforcement Program

ADWR developed a compliance and enforcement program to ensure that conservation requirements are being met. The annual water withdrawal and use reports previously mentioned are one part of this program. Additionally, ADWR conducts audits to determine if water users comply with conservation requirements. If a water user is out of compliance, ADWR sends out a notice of non-compliance, conducts post audit meetings with the water user, and attempt to negotiate a settlement for excess groundwater used.

Conservation and Augmentation Assistance Programs

In 1991, the 2MP was modified to include a program for conservation assistance to water users within an AMA. The goal of the Conservation Assistance Program is to assist water users in achieving the Management Plan requirements, leading ultimately to a realization of the management goal of the AMA.

The 2MP and the 3MP also include an Augmentation Assistance Program designed to provide augmentation grants for construction and pilot recharge projects designed to directly increase water supplies or water storage, conservation assistance, and planning, research and feasibility studies.

The Conservation Assistance and Augmentation Assistance Program grants are funded by groundwater withdrawal fees collected from those who pump groundwater in each AMA.

1.5 The Assured Water Supply Program

The Assured Water Supply (AWS) program, created as part of the Code, is designed to preserve groundwater resources and to promote long-term water supply planning in the AMAs. This is accomplished by regulations that limit the use of groundwater by new subdivisions. Every person proposing to subdivide land within an AMA must demonstrate the availability of a 100-year AWS.

In 1995, ADWR adopted AWS Rules to implement the AWS program. Under the AWS Rules, developers can demonstrate a 100-year supply by either satisfying the criteria described below and obtaining a Certificate of Assured Water Supply (CAWS) from ADWR or by obtaining a written commitment of service from a water provider that has a Designation of Assured Water Supply (DAWS).

An AWS demonstration must include proof that the proposed subdivision will meet the following criteria, that the water supply or supplies: 1) will be of adequate quality; 2) will be physically, legally, and continuously available for the next 100 years; 3) will be consistent with the management goal for the AMA; 4) will be consistent with the Management Plan for the AMA; and 5) financial capability will be demonstrated to construct the necessary water storage, treatment and delivery systems. The Arizona Department of Real Estate will not issue a public report that allows the developer to sell lots without a demonstration of an AWS within an AMA. For more information on the AWS Program, please visit the ADWR website at www.azwater.gov/AzDWR/WaterManagement/AAWS.

The AWS requirement is only one important tool to help attain the management goal of the AMA. Because the AWS requirements only apply to new subdivisions (existing uses and other non-subdivision new uses are exempt from the AWS requirement under the Code), its ability on its own to bring the AMA into safe-yield is limited.

1.6 The Underground Storage and Recovery Program

For decades, more groundwater has been pumped from Arizona's aquifers than has naturally recharged back into the aquifers. This imbalance has left some aquifers significantly depleted. Using renewable supplies and recharging water underground reduces this imbalance. Artificial recharge is a means of storing excess water supplies so that they may be used in the future. Artificial recharge is an increasingly important tool in the management of Arizona's water supplies, particularly in meeting the goals of the Code. Storing water underground to ensure an adequate supply for the purpose of satisfying current and future needs is both a practical and cost-effective alternative to direct use of renewable supplies.

In 1986, the Arizona Legislature established the Underground Water Storage and Recovery program to allow persons with surplus supplies of water to store that water underground and recover it at a later time. In 1994, the Legislature enacted the Underground Water Storage, Savings, and Replenishment Act, which further refined the recharge program.

A person who wished to store, save, replenish, or recover water through the recharge program must apply for permits through ADWR. Depending on what the applicant intends to accomplish, different types of permits may be required.

An Underground Storage Facility (USF) Permit allows the permit holder to operate a facility that stores water in the aquifer. A Constructed USF Permit allows for water to be stored in an aquifer by using some type of constructed device such as an injection well or percolation basin. A Managed USF permit allows for water to be discharged into a naturally water-transmissive area such as a streambed that allows the water to percolate into the aquifer without the assistance of a constructed device.

A Groundwater Savings Facility (GSF) Permit allows renewable water supplies, owned by the water storer, to be delivered to a separate recipient who agrees to curtail groundwater pumping on a gallon-for-gallon basis, thus creating a groundwater savings.

A Water Storage Permit allows the permit holder to store water at a USF or GSF. In order to store water, the applicant must provide to ADWR evidence of its legal right to the source water proposed for recharge. Water storage must occur at a permitted facility, as described above.

A Recovery Well Permit allows the permit holder to recover long-term storage credits or to recover stored water annually. Recovery can occur inside the area of impact of the stored water (the area where the water artificially recharged into the aquifer actually occurs) or outside the impact area of the stored water; however, recovery must occur in the same AMA where the water was stored. For more information on the Underground Storage and Recovery Program, please visit the ADWR website at www.azwater.gov/AzDWR/WaterManagement/Recharge.

PART II BASIC BUDGET COMPONENTS AND CALCULATION OF OVERDRAFT

2. BUDGET DATA OVERVIEW

The historical data contained in this Assessment were compiled from Annual Water Withdrawal and Use Reports (annual reports) filed by water users since 1984; other components required to estimate both historical and projected overdraft came from the Prescott AMA Groundwater Model, updated in 2002 (Nelson K. , Application of the Prescott Active Management Area Groundwater Flow Model Planning Scenario 1999-2025., 2002) and the transient model, updated through 2004 (Timmons, 2006). The detailed data set compiled during this effort is stored in the Prescott Master Data Template (Template)(ADWR, 2010) . The Template is an inventory of the demand and supply for the AMA. The data housed in the Template has been summarized in a budget format, referred to as the Summary Budget. Both the Template and Summary Budget are available online at www.azwater.gov/AzDWR/WaterManagement/Assessments.

In order to be consistent across the years and sectors, staff took extensive efforts to re-evaluate demand and supply data from the individual annual reports submitted by water providers, irrigation districts, industrial facilities, farms and recharge facilities to populate the Template and Summary Budget, rather than relying on previously compiled totals. The years considered as the historical period for the Assessment are 1985 to 2006. During those 21 years, the data required by annual reports has become more complicated as the statutes, rules and Management Plans have changed, and as water management itself has become more complex.

Meanwhile, the methods used to store, retrieve and compile the data have become more sophisticated. This evolution of data development and retrieval may cause the more recently compiled totals for demand or supply to be slightly inconsistent with previously published numbers in previous Management Plans. While data reporting details and data retrieval have changed over the years, annual water use data have been reported in a relatively consistent manner for over 21 years. This long period of consecutive annual reporting provides the opportunity for ADWR to analyze past use and project future water demand using the longest period of record yet available. The data regarding future potential demand and supply were projected using various methods, as explained in detail beginning in Part III. Appendices 1-8 contain additional information regarding how these numbers were developed.

3. THE BASIC BUDGET COMPONENTS

The basic components of the Summary Budget are demand, supply, artificial recharge, and offsets to overdraft. Each of these components, necessary for calculating overdraft, is discussed in detail in the following sections.

3.1 Demand

Demand consists of the beneficial use of water for cultural purposes by the Municipal, Industrial, and Agricultural sectors.

3.1.1 Municipal Demand

Municipal water use includes water delivered for non-irrigation uses by a city, town, private water company or irrigation district. Municipal demand is composed of the Large Provider, Small Provider, Institutional Provider, and Domestic Exempt subsectors. The demand of Individual Users, such as turf-related facilities, is also included in the Municipal demand since municipal providers often serve them. These subsectors are listed and defined below in the order of magnitude of use.

Large Provider Demand: Large provider demand is the sum of residential, non-residential, and lost and unaccounted for water delivered by a large provider. A large provider is a municipal provider serving more than 250 acre feet of water for non-irrigation use per year.

The components of large provider Demand are as follows:

Large Provider Residential Deliveries: A non-irrigation use of water, delivered by a large provider, related to the activities of a single family or multifamily housing units, including interior and exterior water use.

Large Provider Non-residential Deliveries: Water supplied by a large provider for a non-irrigation use other than a residential use. Deliveries to individual users are included in this category. Individual users are facilities that receive water from a municipal provider for non-irrigation uses to which specific Industrial conservation requirements apply, including turf-related facilities, large-scale cooling facilities, and publicly owned rights-of-way.

Large Provider Lost and Unaccounted for water: The difference between the total water withdrawn, diverted or received for use within the water provider's water service area and the sum of the residential and non-residential metered deliveries to customers.

Small Provider Demand: Small provider demand consists of deliveries by a municipal provider for non-irrigation use related to the activities of single family or multifamily housing units. Small provider demand may also include deliveries to non-residential customers and individual users.

A small provider is a municipal provider that supplies 250 acre-feet or less of water for non-irrigation use per year.

Domestic Exempt: Domestic Exempt Water use is non-irrigation water supplied by exempt wells (pumping not more than 35 gallons per minute) for domestic purposes to persons not on a large or small provider distribution system.

Population Numbers: Although not used directly to calculate water use during the historical period, population numbers are included in the Template and are broken out by persons served by large providers, small providers and those who use domestic exempt wells. Population is used directly in the projected scenarios to estimate Municipal use.

3.1.2 Industrial Demand

Industrial use is a non-irrigation use of water, not supplied by a city, town, or private water company, including animal industry use and expanded animal industry use. In general, Industrial users withdraw water from their own wells that are associated with Type 1 and Type 2 rights, GIUs or other withdrawal permits. In the Prescott AMA, Industrial demand is composed of the following subsectors: Sand and Gravel, Turf, and Other. All of these categories have specific conservation requirements. The subsectors are defined below.

Sand and gravel: Sand and Gravel demand is the water use at a facility that produces sand and gravel and that uses more than 100 acre-feet of water from any source per year.

Turf: Turf demand is the water use by cemeteries, golf courses, parks, schools, or common areas within housing developments with a water-intensive landscaped area of 10 or more acres. Turf-related facilities that use any groundwater, regardless of whether they are Industrial users or are served by a municipal provider (individual user) have a maximum annual water allotment based on the size and age of the facility. Golf course demand is water use at turf-related facilities that are used for playing golf that have a minimum of nine holes including any practice areas.

Other Industrial: Other Industrial demand is the non-irrigation use of water not supplied by a city, town, or private water company, including animal industry use and expanded animal industry use, that are not included in any of the specific Industrial subsectors described above.

3.1.3 Agricultural Demand

Agricultural demand is composed of the use of water by IGFRs for agricultural uses not on Indian Reservations, and its associated lost and unaccounted for water. Agricultural use is the application of water to two or more acres of land to produce plants or parts of plants for sale or human consumption, or for use as feed for livestock, range livestock or poultry. In the Prescott AMA, and the other AMAs, only land associated with a certificate of IGFR can legally be irrigated with groundwater. During the early 1980s, ADWR issued these certificates based on the types of crops and the number of acres planted from 1975 to 1980. Land not irrigated during this period may not be irrigated, except under certain circumstances. The sub-categories of non-exempt demand and lost and unaccounted for are explained below:

Non-Exempt IGFRs: Non-exempt IGFR use is the water use on land to which an IGFR is appurtenant and is greater than ten acres in size, or greater than two acres in size and part of an integrated farming operation. A person using groundwater pursuant to a non-exempt IGFR must comply with conservation requirements established in the Management Plan for each management period. Historically, the Base Conservation Program requirements were allotment-based: the number of IGFR acres was multiplied by the average water duty (the quantity of water reasonably required for crops grown on the IGFR acres between 1975 and 1980); the result was then divided by an assigned irrigation efficiency listed in each Management Plan (ADWR, 1999). Beginning in 2003, an optional BMP program was developed for non-exempt IGFRs as an alternative to allotments in the Base Conservation Program (ADWR, 2003).

Exempt IGFRs: In 1994, IGFRs less than ten acres in size and not part of an integrated farming operation were exempted from conservation requirements and reporting obligations. There are such IGFRs in the Prescott AMA and historical water use by these rights is included in this assessment.

Agricultural Lost and Unaccounted for Water: This lost water is the total amount of water pumped or diverted minus the demand.

3.2 Supply

Since the 1970's, water users in the Prescott AMA have relied heavily on groundwater. The following is a list of water supplies used during the period of 1985 to 2006 to meet the demands of the sectors in the Prescott AMA.

Groundwater: Groundwater is water from below the earth's surface.

Reclaimed Water: Reclaimed water is water that has been collected in a sanitary sewer for subsequent treatment in a facility that is regulated as a sewage system, disposal plant or wastewater treatment facility. Such water remains reclaimed water until it acquires the characteristics of groundwater or surface water.

Recovered Reclaimed Water: Recovered reclaimed water is water that was stored in either an USF or a GSF, and then recovered under the authority of a recovery well permit. When recovered, this water legally counts as reclaimed water. In graphs in this Assessment that depict water use by source, recovered reclaimed water is included with reclaimed water in the category "reclaimed water".

Surface water: Surface water is the waters of all sources, flowing in streams, canyons, ravines or other natural channels, or in definite underground channels, whether perennial or intermittent, floodwater, wastewater or surplus water, and of lakes, ponds and springs on the surface. The Prescott AMA has limited access to alternative surface water supplies.

Table 3-1 lists the sources that are in use, or have been used by each sector at some point from 1985 through 2006. These water supplies used historically in the Prescott AMA are the same supplies anticipated to be used in the future. However, one of the projected scenarios includes groundwater transported into the AMA from the Big Chino Sub-basin.

Table 3-1 Historical Sector Use of Water Supplies Through 2006
Prescott Active Management Area

Source	Municipal	Industrial	Agriculture
Groundwater	√	√	√
Reclaimed water	√		√
Recovered Reclaimed water	√		√
Surface water	√	√	√
Recovered Surface water	√		

3.3 Artificial Recharge

Artificial Recharge is a means of artificially adding water to the aquifer. In the Prescott AMA, artificial recharge is accomplished through the use of USFs as described in Section 1.6. Water stored at these sites becomes long-term storage credits for the storers, which can be recovered at a later date. At the time these long-term storage credits are used (recovered), the recovered water retains the legal characteristic of the water supply stored at the recharge facility. Water may also be stored at USFs on an annual basis so that it is stored and recovered during the same calendar year and does not accrue a long-term storage credit.

Underground Storage Facilities (USFs): A USF is a facility that stores water in the aquifer. There are two types: *Constructed* and *Managed.* A Constructed USF is one in which water is stored in an aquifer by using some type of constructed device, such as an injection well or percolation basin. A Managed USF is a facility at which water is discharged to a naturally water-transmissive area, such as a streambed, that allows the water to percolate into the aquifer without the assistance of a constructed device. Historically, USFs in Prescott have stored reclaimed water and a very small amount of surface water.

Artificial recharge plays an important role in meeting the safe-yield management goal. Pursuant to the AWS requirements, development associated with CAWS and DAWS must prove 100-year water supplies that are consistent with the Prescott AMA safe-yield management goal. This dictates that most or all of these supplies must come from renewable sources. For example, using reclaimed water can meet or offset a provider's obligation to use renewable supplies.

Another mechanism that can be used to assist the AMA in achieving its management goal is unrecoverable recharge (or groundwater augmentation). Although this is rarely, if ever, used, an entity could recharge water for the benefit of the AMA, without accruing long-term storage credits. The stored water does not retain its original legal characteristic but would simply become part of the available groundwater supply for the benefit of all water users in the AMA. The City of Prescott holds a non-recoverable permit with a maximum storage of 7,200 acre-feet per year. The City has not stored any water pursuant to this permit to date.

Underground storage and recovery is an important water management tool, but it does not always directly offset overdraft. Even though local water levels may rise in the areas of hydrologic impact of artificial recharge, that water is in effect already spoken for – it has been stored with the intent of recovering it later.

3.4 Offsets to Overdraft

Offsets to overdraft are quantities of water that recharge the aquifer, either as a result of the natural system or cultural activity, and therefore "offset", at least in part, groundwater pumping. These include net natural recharge, incidental recharge, supplies identified in the AWS Rules, reclaimed water discharge, and conservation.

3.4.1 Net Natural Recharge

The natural components that affect overdraft include mountain front recharge, streambed infiltration of runoff, and underflow (subsurface migration of water) out of the Prescott AMA. These components are described in more detail below.

Mountain Front Recharge: Mountain front recharge is natural recharge that originates as precipitation falling in the mountains of the two groundwater sub-basins (Upper Agua Fria and Little Chino) that comprise the Prescott AMA. Precipitation falling in the mountains has the highest rate of recharge with decreasing recharge rates in sub-basin centers. In most years, mountain front recharge is the largest source of natural inflow into the Prescott AMA.

<u>*Streambed infiltration*</u>: Streambed recharge occurs when precipitation creates flow events that infiltrate into normally dry, or lower flowing, creeks and rivers. In the Prescott AMA, streambed recharge occurs infrequently along major tributaries including Granite Creek and Lynx Creek and in the Mint Wash area.

<u>*Groundwater Outflow:*</u> Groundwater outflow occurs when groundwater leaves the Prescott AMA at Del Rio Springs and along the Agua Fria River as base flow, and as underflow at Del Rio Springs.

The sum of mountain front recharge and streambed infiltration minus outflow gives the total *Net Natural Recharge*. The amount of Net Natural Recharge can vary from year to year with the amount of precipitation and the timing and magnitude of storm events. For this Assessment, within the 1985-2006 time period, Mountain Front Recharge was based on long-term historical rates and held constant at 5,800 acre-feet per year. Streambed infiltration was variable and based on actual flood events. Groundwater Outflow was held constant at 4,100 acre-feet per year based on groundwater model simulations. For the 2006-2025 period, a fixed value of 8,100 acre-feet was utilized for the combined contribution of mountain front and stream channel recharges (See *Table 3-2*).

Table 3-2 Specific Streambed Recharge Values
Prescott Active Management Area

Year	MFR (acre-feet/year)	Flood Recharge (acre-feet/year)			Total (acre-feet/year)
		Granite Creek	Agua Fria/ Lynx Creek	Mint Wash	
1984-1992	5,800	0	0	0	5,800
1993	5,800	18,720	3,370	213	28,103
1994	5,800	0	0	0	5,800
1995	5,800	4,320	780	49	10,949
1996-2002	5,800	0	0	0	5,800
2003	5,800	850	0	0	6,650
2004	5,800	0	0	0	5,800
2005	5,800	18,690	2,850	185	27,525
2006-2007	5,800	0	0	0	5,800
2008	5,800	4,800	740	54	11,394
Average 1978-2008 No. of years: 31	**5,800**	**1,931**	**322**	**21**	**8,074**
		2,274			

Additional discussion regarding these components and their volumes can be found in (Timmons, 2006) and (Nelson K. L., 2002). Note that Timmons identified net natural recharge as one of the more uncertain parameters in the Prescott AMA groundwater flow model.

3.4.2 Incidental Recharge

Incidental recharge occurs as a by-product of water used for human activities; an example is percolation of irrigation water below the root zone of irrigated crops. ADWR assigns incidental recharge rates for Industrial and Agricultural demands and for canal seepage depending on the water use sector and nature of the water use (See *Table 3-3*). In the Prescott (and Santa Cruz) AMA, there is no incidental recharge rate for Municipal demand as there is for the other three AMAs. This is because there is no provision for an incidental recharge component within the Arizona Administrative Code rules for AWS.

For purposes of this Assessment, incidental recharge for the Industrial and Agricultural sectors is assumed to occur in the year the water is applied.

The final component of incidental recharge is *Canal Seepage*, which is the water that seeps annually into the aquifer from canals. Canal seepage amounts for this assessment were obtained from (Nelson K. L., 2002), and (Timmons, 2006). Canal seepage goes to zero in 2000 due to an agreement between the Chino Valley Irrigation District (CVID) and the City of Prescott (*See Section 5.3.3*). It is recognized that there is still some volume of canal seepage within the distribution system of CVID, however, it has not been estimated by ADWR and is not included within this Assessment.

Table 3-3 Incidental Recharge Rates Used in the Summary Budget
1985, 1995, and 2006
Prescott Active Management Area

Source of Incidental Recharge	**Rate or Amount Applied to Source of Recharge**		
	1985	1995	2006
Agricultural Demand			
Agriculture	50%	50%	50%
Industrial Demand			
Turf-related Facilities, and Sand and Gravel Operations	12%	12%	12%
Other Facilities	4%	4%	4%
Canal Seepage (acre-feet)	1,988	1,346	0

3.4.3 Cuts to the Aquifer

Pursuant to the Underground Storage and Recovery Program, permitted artificial recharge, in many cases, requires that a certain percentage of the recharged volume be made non-recoverable to benefit the aquifer. These required non-recoverable volumes are called *cuts to the aquifer*. The cuts apply to the storage of water for long-term storage credits. They do not apply to water that is stored and recovered annually. In the Prescott AMA, due to the type of recharge that has occurred and is projected to occur in the future, this particular offset to overdraft is insignificant. During the historic period, there were only two years in which a cut to the aquifer occurred. In 2003 and 2004, a combined volume of less than 1,000 acre-feet was included as a cut to the aquifer.

3.4.4 Assured Water Supply and Replenishment

The AWS Rules require use of primarily renewable supplies, such as reclaimed water, by DAWS and CAWS issued in the Prescott AMA after the determination that the Prescott AMA was no longer in a state of safe-yield (1999). However, pursuant to the AWS Rules, a certain volume of groundwater is allowed to be used. These groundwater allowances are intended to help municipal providers transition from groundwater to renewable supplies. Therefore, a certain amount of groundwater use by a DAWS or CAWS in the Prescott AMA is classified as allowable groundwater.

When a DAWS or CAWS is issued, a groundwater allowance account is established. ADWR credits additional allowable groundwater to these accounts based on a number of factors. The AWS Rules allow for a limited volume of groundwater to be pumped based on formulas for each AMA in the AWS Rules. The volume of this allowable groundwater use is reduced over time to zero in 2025 in the Prescott AMA.

The AWS Rules also allow for a DAWS or CAWS to add to the groundwater allowance by extinguishing (or retiring) grandfathered rights (IGFRs, Type 1 and Type 2 rights) within the same AMA. The calculation of these extinguishment credits are contained in the AWS Rules and are calculated differently for each AMA. Groundwater use reported pursuant to the provider's or subdivision's allowable groundwater volume is considered consistent with the management goal of the AMA.

3.4.5 Reclaimed Water Discharge

It is recognized that some volume of reclaimed water was released into the bed of the Agua Fria River by the Town of Prescott Valley that would meet the definition of discharged reclaimed water between 1995 and 2006. However, while the volume that was discharged is known, the volume that was actually recharged is not known and cannot be accurately calculated without significant research and analysis. Therefore, no volume of discharged reclaimed water is included in the Prescott AMA water budget.

3.4.6 Contribution of Conservation and Renewable Supplies

Conservation of water supplies, including groundwater, is not explicitly accounted for in the Summary Budget. However, because less groundwater is withdrawn, conservation intuitively provides a clear benefit toward reaching safe-yield. Each water use sector (Municipal, Agricultural and Industrial) has associated conservation requirements that are described in the *Third Management Plan for Prescott Active Management Area, 2000-2010*.

Direct use of renewable supplies also offsets the amount of groundwater that would otherwise be used, and assists in reaching safe-yield. Management Plan provisions provide incentives for use of renewable supplies including surface water and reclaimed water to meet conservation requirements.

4. CALCULATING OVERDRAFT IN THE SUMMARY BUDGET

The management goal of the Prescott AMA is safe-yield; therefore, monitoring the effects of the cumulative impacts of demand on the aquifer is critical. The components listed in Section 3 above are included in the Summary Budget and are critical in identifying the AMA's success toward achieving the statutory management goal of safe-yield. If the AMA has not achieved safe-yield, it is in an overdraft condition and the ADWR uses this information to evaluate what additional tools are necessary to assist the AMA in achieving its goal.

Table 4-1 lists the various inputs to and withdrawals from the aquifer that are used to estimate groundwater overdraft. Inputs, which are considered additions to the aquifer, include incidental recharge contributed by the various sectors, net natural recharge and cuts to the aquifer as required by the Underground Storage and Recovery statutes (*See Section 3.4 for a discussion on these components*).

Withdrawals from the aquifer include withdrawals of groundwater by various water use sectors and groundwater outflow.

Table 4-1 Overdraft Inputs and Withdrawals

Inputs	**Withdrawals**
Sector Incidental Recharge	*Sector Pumpage*
Industrial	*Municipal*
Agriculture	*Industrial*
Canal Seepage	*Agriculture*
Net Natural Recharge	
Artificial Recharge Cut to the Aquifer	

Note: Estimated Overdraft (with and without the Groundwater Allowance) = Inputs – Withdrawals

Annual groundwater overdraft is calculated by subtracting withdrawals from the inputs, or recharge. If groundwater withdrawals exceed the offsets or inflows, there is overdraft. Part III describes and quantifies the historical water use and overdraft for the Prescott AMA for the historical period of 1985 to 2006.

PART III HISTORICAL WATER USE AND OVERDRAFT

5. HISTORICAL WATER DEMANDS BY SECTOR

The proportion of water demand among the sectors has changed significantly between 1985 and 2006 with the primary change being a switch between the Agricultural and Municipal sectors. In 1985, Agricultural demand accounted for almost 80 percent of the total AMA demand, with Municipal demand accounting for an additional 18 percent and Industrial demand relatively low. In 1995, Agricultural demand had decreased to approximately 62 percent of demand and Municipal demand had increased to almost 36 percent. By 2006, Agricultural demand had decreased to only 12 percent of demand with Municipal demand increased to 81percent. There was a slight increase in Industrial demand to approximately seven percent.

In 1948, the City of Prescott received its first groundwater as a supplement to the surface water supply that had predominated. In 1975, over 90 percent of the water utilized by the City of Prescott was groundwater supplied by the Chino Valley well field. Historically, a significant portion of Agricultural demand was met with surface water supplied by the Chino Valley Irrigation District (CVID). In 1985, approximately 38% of the total supply was surface water provided by CVID to Agricultural use. In 1998, CVID and the City of Prescott entered into an agreement that resulted in replacing surface water deliveries to agricultural users by CVID with delivery of recovered reclaimed water. The surface water rights were transferred to the City of Prescott who utilizes surface water via annual recharge and recovery. Use of reclaimed water to supply Municipal demand also increased over time. In 2006, groundwater remained the primary source of supply, accounting for approximately 88% of supply; reclaimed water accounted for 11%. About 1% was recovered surface water. Historical demand and supplies for each sector are discussed in more detail below.

5.1 Municipal Sector Demands & Supplies

The Municipal sector in the Prescott AMA includes three categories of water users: Large, small, and domestic exempt well users. The Arizona Corporation Commission regulates 12 of the 21 small providers in the Prescott AMA as private water companies. The other providers are cities, towns, domestic water improvement districts, cooperatives, and mobile home parks.

5.1.1 Municipal Demands

Total Municipal water demand in the Prescott AMA was 14,266 acre-feet greater in 2006 than in 1985, an increase of 300 percent (*See Table 5-1*). The majority of this increase is attributed to the large municipal providers; however, small providers showed increases greater than 200 percent and exempt wells showed increases greater than 150 percent. The number of large providers in the Prescott AMA has remained constant since 1985; however, the number of small providers has increased. *Figure 5-1* shows the locations of the large and small provider service areas. Between 1985 and 2006, the demand from exempt domestic wells in the Prescott AMA has more than doubled.

Table 5-1 *Municipal Water Demand*
1985, 1995 and 2006
Prescott Active Management Area

Municipal Use Category	1985	1995	2006
Large Providers			
Number	2	2	2
Total Use	3,660	8,673	15,787
Groundwater Use	3,450	8,673	13,683
Small Providers			
Number	15	17	21
Total Use	344	463	1,160
Groundwater Use	344	463	1,160
Domestic Well Use			
Number	4,560	6,951	11,035
Total Use	745	1,244	2,069
Groundwater Use	745	1,244	2,069
Total Use	**4,749**	**10,380**	**19,015**
Total Groundwater Use	**4,539**	**10,380**	**16,912**

Note: All volumes are in acre-feet.

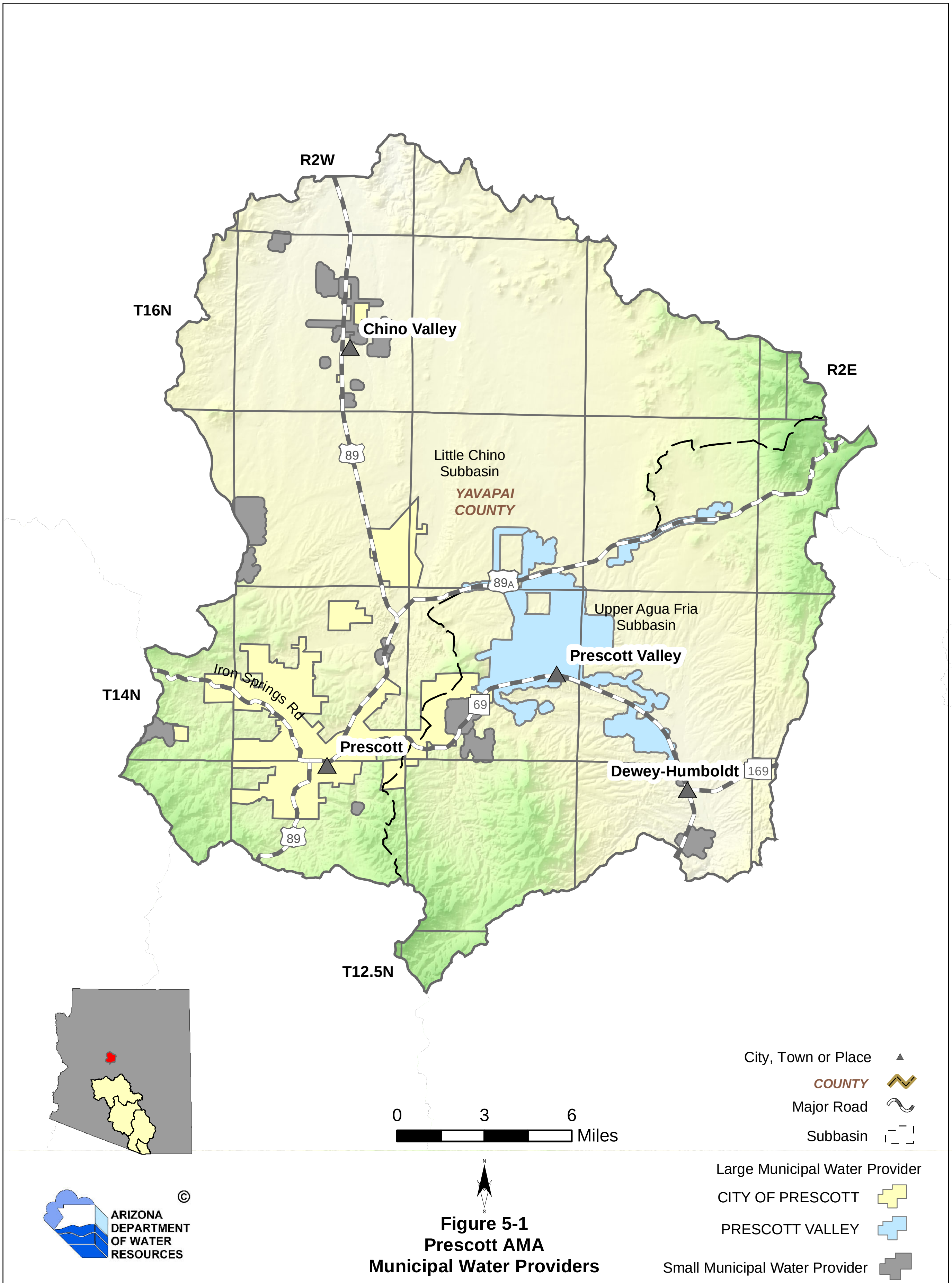
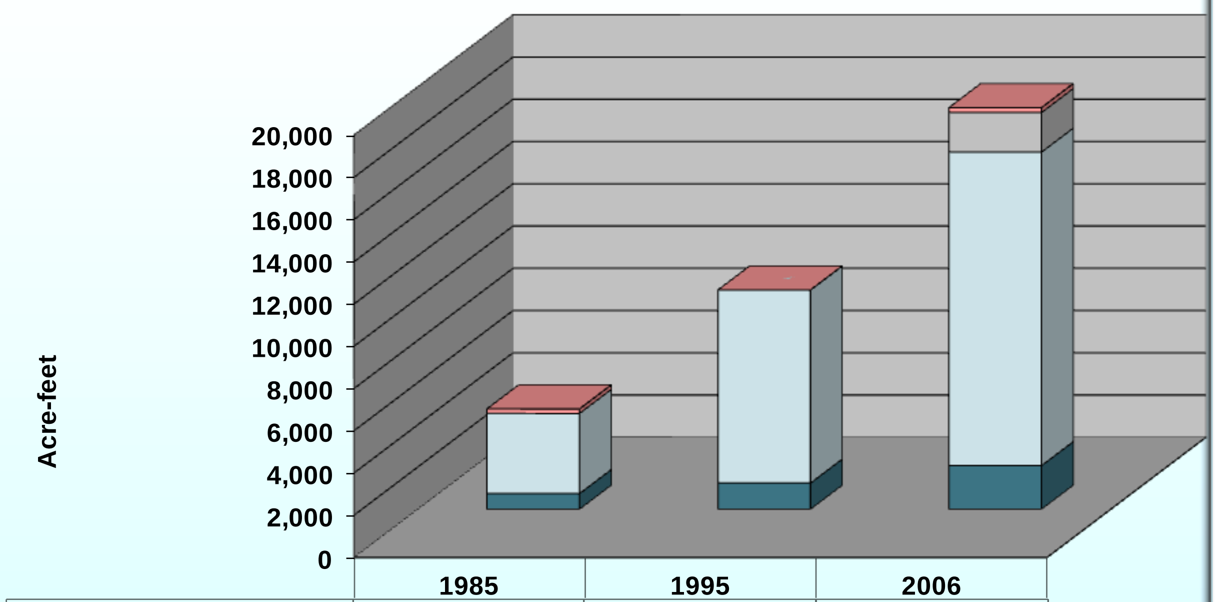


Figure 5-1
Prescott AMA
Municipal Water Providers

5.1.2 Municipal Supply

Groundwater is the largest source of supply used in the Municipal sector. From 1985 through 1988, the Municipal sector used surface water directly, then as recovered surface water from 2000 through 2006. Only the City of Prescott had the ability to utilize surface water supplies for municipal use. The use of reclaimed water for landscape irrigation (golf courses) was initiated in 1988 and continued through 1993; it began again in 2001 and continued through 2006. The use of recovered reclaimed water was initiated in 1998 and continued through 2006.

Figure 5-2 Historical Municipal Supplies 1985, 1995 and 2006
Prescott Active Management Area



	1985	1995	2006
TOTAL	4,749	10,380	19,015
Surface water	210	-	229
Reclaimed water	-	-	1,875
Municipally Provided Groundwater	3,794	9,137	14,843
Exempt Well Groundwater	745	1,244	2,069

5.1.3 Large Municipal Providers

Large Provider Water Use Characteristics

There are currently two large providers in the Prescott AMA (*See Figure 5-1*): the *City of Prescott* and the *Town of Prescott Valley*. The former Shamrock Water Company is now part of the Town of Prescott Valley Municipal System was formed as a new municipal provider to serve a non-contiguous portion of the Town of Prescott Valley. For purposes of this assessment, the sum of both systems is shown as served by the Town of Prescott Valley for the entire period and is included with the City of Prescott as large municipal provider demand. As shown in *Table 5-1*, more than 85 percent of the large municipal provider demand is met with groundwater. Reclaimed water makes up the non-groundwater portion of the demand, increasing from no use in 2000 to almost 2,000 acre-feet in 2006. Reclaimed water is used primarily for golf course irrigation.

Large Provider Demand and Supply

Large provider demand has steadily increased since 1985, increasing more than 300 percent between 1985 and 2006 (*See Table 5-1*).

The *City of Prescott* is the largest water provider in the Prescott AMA. In 2006, the City of Prescott represented approximately 60 percent of the large municipal provider demand. This demand was met with approximately 85% groundwater and approximately 15% reclaimed water.

Factors Affecting Large Provider Water Use

On January 12, 1999, the Prescott AMA was declared to no longer be in a state of safe-yield. New AWS Rules were promulgated following this declaration and those regulations included provisions for the groundwater allowance. In general, the groundwater allowance is the volume of groundwater that can be used in any year by post-declaration CAWS and DAWS consistent with the management goal. For example, in 2006, the City of Prescott met 85 percent of its municipal demand with groundwater. This use of groundwater is "allowed" per the City of Prescott DAWS and quantified with a current maximum of 9,466.02 acre-feet per year over the next 100 years. This groundwater allowance is applicable only to the Municipal sector.

Demand in the Municipal sector in the Prescott AMA has the greatest potential for increase; however, new growth cannot depend on groundwater. Although it is the goal of the AWS Rules to limit the use of groundwater within the Municipal sector, a somewhat unique situation exists in the Prescott AMA. Pre-declaration CAWS were not required to meet the current consistency with goal criteria. This means that those subdivisions can continue to rely on groundwater pumping as their source of supply, in perpetuity. Additionally, there was a provision included in the Prescott AMA AWS Rules granting a grandfathered groundwater allowance volume to certain subdivisions based on their platting status at the time of the declaration. These subdivisions can also continue to rely on groundwater pumping as their source of supply in perpetuity.

In essence, because of the limited access to alternative supplies, the Municipal sector in the Prescott AMA has a disproportionately large groundwater allowance when compared to the other safe-yield AMAs. In 2006, the groundwater allowance use for the Prescott AMA was approximately 42 percent of the total Municipal sector demand. In the same year in the Tucson AMA, the groundwater allowance use was approximately 15 percent of total demand and in the Phoenix AMA, approximately 11 percent.

However, for new subdivision development, the availability of renewable water supplies will affect growth. Underground storage of renewable supplies is a method of meeting the AWS Rule requirements for consistency with the safe-yield water management goal and mitigating the effects of short-term drought. There are limited geographic areas suitable for underground storage in the Prescott AMA; however, there are more opportunities to store and recover water than are currently being used. Reclaimed water is a renewable source of supply that could either be used directly for landscape irrigation or be stored and recovered. Another supply that can be utilized pursuant to the AWS Rules is groundwater transported into the AMA from the Big Chino Sub-basin. Utilization of this source of supply is discussed in section 13.2 of this Assessment.

The City of Prescott is the only municipal water provider in the Prescott AMA who holds a DAWS. The City's DAWS was modified on December 30, 2009. The DAWS includes a projected estimated demand of 16,397 acre-feet for the year 2023 and 20,675 acre-feet for the year 2027 that includes 8,067 acre-feet of water from the Big Chino Subbasin.

5.1.4 Small Municipal Providers

Small Provider Water Use Characteristics

Both the number of small municipal providers and small provider demand has increased in the Prescott AMA since 1985 (See Table *5-1*). However, the primary increase in demand is within the new small provider service areas. Sixty percent of the small providers present in 1985 showed little or no population increase within their service areas through 2006. Small providers rely solely on groundwater.

Small Provider Demand and Supply

Small provider population has increased, growing from 2,191 people in 1985 to 9,351 people in 2006. Consequently, small provider demand has also increased steadily since 1985 (*See* Table *5-1*). Due to the nature of small providers in the Prescott AMA, the impact of the 1993 statutory change that redefined large providers and small providers is not seen. Small provider demand increased from 344 acre-feet to 1,160 acre-feet between 1985 and 2006.

Small providers within the Prescott AMA use 100 percent groundwater.

Factors Affecting Small Provider Water Use

Small providers have little incentive to initiate use of renewable supplies and in most instances, small providers within the Prescott AMA have no access to them. New subdivisions served by small providers must obtain a CAWS. If the CAWS is issued, the subdivision can meet the consistency with the management goal requirement through a combination of using their groundwater allowance or extinguishment credits.

5.1.5 Exempt Well Demand and Supply

The number of exempt wells has increased steadily from 4,560 in 1985 to 11,035 in 2006. Exempt well demand is estimated to have been about 2,069 acre-feet in 2006.

Exempt Well Demand and Supply

Calculating a volume of water associated with exempt domestic wells is recognized nationwide as being a difficult endeavor. Additionally, domestic use from exempt wells was identified as an issue of concern within the Prescott AMA, most recently within the Final Report of the Safe-yield Subcommittee (2006). Consequently, the calculation of exempt domestic well demand was treated more rigorously within the Prescott AMA than other AMAs.

A methodology that applied a volume of use to each well was not selected for a number of reasons. Although the number of registered exempt domestic wells can be identified through a database query, the entity executing the query must make a number of assumptions that may or may not be valid. Additionally, there may be multiple wells on a single parcel, or single exempt domestic wells providing more than one household. In many instances, exempt domestic wells in the Prescott AMA are extremely low producing wells. In those instances, assigning a volume per day value to those wells greatly overestimates the actual water use.

Therefore, a population based method was selected although it is recognized that this method also has inherent issues. In this method, the population that must utilize water from exempt domestic wells is identified and then a volume of water use is applied to each person.

The population that must receive water from exempt domestic wells was calculated using the 2000 Census data as a base. The population that received water from large and small providers were subtracted from the population of the entire Prescott AMA, leaving the exempt domestic well population. From 2000, the population was projected back to 1985 in a manner that mirrored the average small provider population change for the same period (5 percent change per year). Between 2000 and 2006, the population was projected in a manner that mirrored the average large provider population change (4.3 percent change per year). These calculations resulted in a 1985 exempt well population of 7,385 people and a population of 20,522 people in 2006.

Within the Prescott AMA, the volume of use associated with an exempt domestic well has historically been assumed to be 85 gallons per capita per day (GPCD). At issue in the Prescott AMA was whether there could potentially be variable water use from domestic wells based on lot size. In general, the assumption was that residences on larger lots have a higher GPCD due to the greater amount of exterior water use. Conversely, the assumption could be that residents on small lots, such as within mobile home parks, would have lower GPCDs due to the absence of water use outside the residence. If this variability existed, application of one GPCD rate to the entire domestic well population would not be an accurate estimate of domestic water use from exempt wells.

Because actual water use information could not be obtained from exempt domestic well users, it was decided that the small provider water use obtained from annual water use reports would be examined and characterized based on lot size to determine GPCD rates. This examination showed variability in water use based on lot size and type of residence. Upon additional examination, including field inspection, a determination was made that an average GPCD for exempt domestic wells in the Prescott AMA is 90.

Exempt domestic wells are assumed to use 100 percent groundwater.

Factors Affecting Exempt Well Use

Because exempt wells are unregulated, there is no requirement or incentive to use renewable supplies. Under the AWS Rules, dry lot subdivisions of 20 or fewer lots are not required to meet the consistency with management goal requirement. A dry lot subdivision is a development where each lot purchaser is responsible for drilling and maintaining his or her own private domestic exempt well. New exempt wells added to the Prescott AMA, either in small subdivisions or through un-subdivided lot splits, would contribute to overdraft within the current regulatory framework.

5.2 Industrial Sector Demands and Supplies

The Code defines Industrial use as a non-irrigation use of water, not supplied by a city, town or private water company, including animal industry use and expanded animal industry use. In general, Industrial users withdraw water from their own wells that are associated with grandfathered groundwater water rights (Type 1 and Type 2 rights) or withdrawal permits (*See Table 5-2*). Although industrial users are primarily dependant on groundwater, some use renewable supplies such as surface water. Historically, industrial uses in the Prescott AMA included turf related facilities, sand and gravel operations, and other industrial uses such as small landscape users, cooling uses, construction, and others. For more information regarding Industrial users, refer to Section 3.1.2.

5.2.1 Overview of Industrial Rights and Authorities

Type 1 and Type 2 rights are the predominant withdrawal authority used by Industrial users. Industrial users can also withdraw water pursuant to groundwater withdrawal permits such as GIU permits or Mineral Extraction permits (limited permits used for mining operations or sand and gravel operations). All of these rights and permits have an allotment associated with them that limits the amount of water that can be withdrawn on an annual basis. In addition to these associated right and permit allotments, certain types of Industrial facilities are subject to conservation requirements that may impose additional restrictions on the amount of water that can be used at a facility.

Table 5-2 Industrial Groundwater Rights and Withdrawal Summary
2006
Prescott Active Management Area

User Category	Right or Permits	Number of Facilities	Right or Permit Volume (acre feet)	Groundwater Use (acre feet)	Total Water Use (acre feet)
Sand and Gravel Facilities	Surface Water Right	1	NA	0	126
Turf-Related Facilities	Type 1 & Type 2s	2	846	793	793
Other Industrial Facilities	Type 1 & Type 2; GIU Permit; Hydro Test Permit	43[1]	6,729	567	567
Total		**46**	**7,575**	**1360**	**1486**

[1] Number of rights.

Industrial use is dependent on population growth and the economy. In some cases, the difference between the actual water use and the total allotment is substantial (*See Table 5-2*), and is generally explained as a result of the allocation process used to establish Type 2 rights. This process assigned users allotments based on the highest annual groundwater withdrawal between the years 1975 and 1980. In 2006, less than 20 percent of the Prescott AMA's industrial rights and permit volumes were used.

Approximately 48% of the total Type 1 and Type 2 allotments in the Prescott AMA belong to the City of Prescott, whose Type 2 right has an allotment of 3,169 acre-feet. In 1995, this Type 2 was pledged by the City to the Yavapai-Prescott Indian Tribe (YPIT) to guarantee them water service pursuant to the YPIT Settlement. Consequently, this Type 2 right will likely never be utilized unless the YPIT population grows beyond the City of Prescott's capacity to meet their water needs.

5.2.2 Industrial Demand and Supply by Subsector

Historically, the Industrial sector in the Prescott AMA has been quite small. Total sector water use in 1985 was 641 acre-feet, or 2.5 percent of the Prescott AMA's total water use; by 1995, it had only grown to 696 acre-feet. By 2006, total demand had grown to 1,486 acre-feet, or approximately 6 percent of the AMA's total water use. Turf water use and other industrial use currently dominate the AMA's industrial sector (*See Table 5-3*).

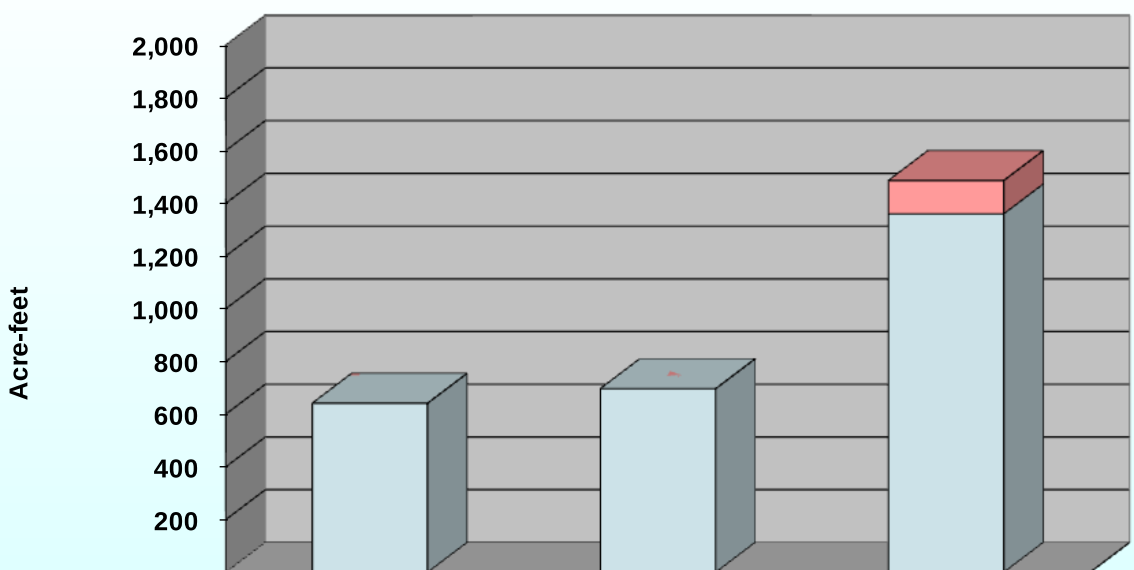
Table 5-3 Industrial Water Demand by Subsector
1985, 1995 and 2006
Prescott Active Management Area

Type of Facility	1985	1995	2006
Sand and Gravel Operations	135	152	126
Turf-Related Facility	0	391	793
Other Industrial Users	506	153	567
Total	**641**	**696**	**1,486**

Note: All volumes are in acre-feet.

Groundwater has been, and continues to be, the primary source of Industrial water supply in the Prescott AMA (*See Figure 5-3*). Each sub-sector of Industrial water demand and supply are discussed below.

Figure 5-3 Historical Industrial Supplies 1985, 1995 and 2006
Prescott Active Management Area

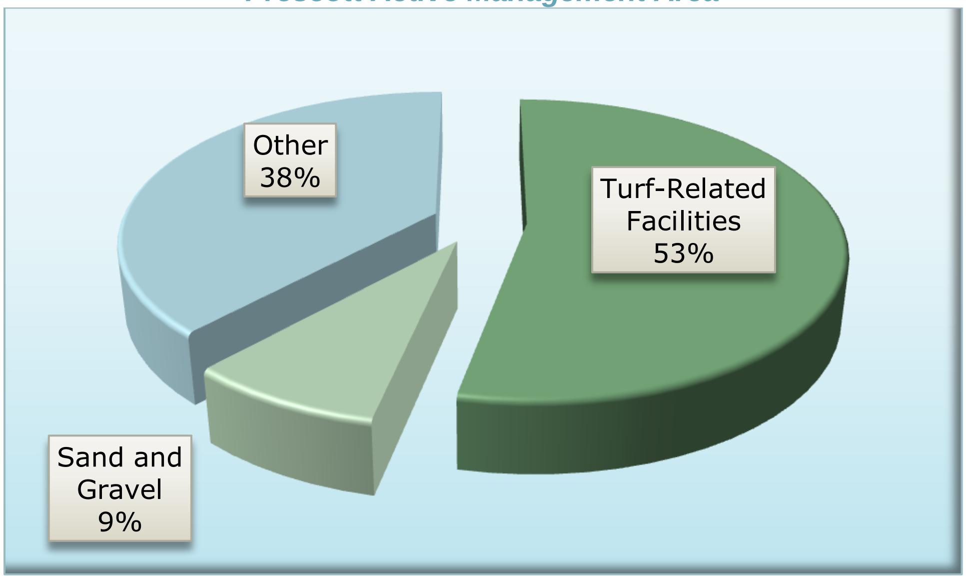


	1985	1995	2006
TOTAL	641	696	1,486
Surface Water	-	-	126
Groundwater	641	696	1,360

Turf-Related Facilities

A turf-related facility is defined in the *Third Management Plan for Prescott Active Management Area, 2000-2010* as a facility with 10 or more acres of water intensive landscaped area. Turf-related facilities are generally parks, schools, cemeteries, and golf courses. In 2006, there were six turf-related facilities in the Prescott AMA. Two of the facilities used groundwater from their own wells and water rights and were considered Industrial users. The other four received reclaimed water from nearby municipal providers. These four are not considered Industrial users in this discussion and their use is described under the municipal sector use. In 2006, turf-related facilities accounted for approximately 53% of all Industrial demand (*See Figure* 5-4). Water use at turf facilities less than 10 acres in size is categorized as other Industrial use.

Figure 5-4 Proportion of Industrial Demand by Subsectors 2006 Prescott Active Management Area



Sand and Gravel

Sand and gravel facilities use in the Prescott AMA has been relatively constant over the last twenty years (*See Table 5-3)*. Water in this subsector is primarily used to wash aggregate before sale; a small amount is used to clean trucks and equipment and for dust control. Increases in sand and gravel production can be tied to population growth and urbanization, but that trend was not seen in the Prescott AMA. Sand and gravel operations in the Prescott AMA have historically utilized groundwater and surface water.

Other Industrial

Other Industrial is a water use category that typically includes a variety of commercial and manufacturing uses that do not fit into the subsectors listed above. Other Industrial water use has historically fluctuated in the Prescott AMA but in 2006, approximately one-third of the total industrial demand was categorized in this manner. Groundwater has historically been used to meet the demands of this subsector.

5.3 Agricultural Sector Demands and Supplies

5.3.1 Overview of Agricultural Rights and Allotments

As mentioned previously, only land associated with a certificate of IGFR can legally be irrigated with groundwater within an AMA (*See Figure 5-5*). IGFRs are categorized as either non-exempt or exempt. Non-exempt IGFRs have specific conservation requirements established in the Management Plan for each management period. Exempt IGFRs, which are ten acres or less and not part of an integrated farming operation, are no longer required to comply with specific conservation requirements. For more information on IGFRs, refer to Section 3.1.3. In 1985, the number of large and small non-exempt irrigation rights was roughly equal; nevertheless, the small rights only accounted for approximately 7% of the total number of certified irrigation acres and allotment volume. After 1993, the majority of small rights were given exempt status.

Since the Code generally prohibits newly irrigated acres, the total number of IGFR certified acres has decreased over time as lands have urbanized (*See Table 5-4*). However, a statutory provision allowing late applications for certificates of grandfathered rights has resulted in increases in certified acres in certain years. The decrease in allotments was due, in part, to the reduction in acreage, but it was also due to reductions in assigned irrigation efficiencies as a result of Management Plan requirements. Historically, use has been substantially lower than allotments; in the future, use may exceed allotments because of flexibility accounting provisions in the Base Program.

The probability of this occurring within the Prescott AMA is small because, in many situations, it is physically impossible to use the majority of accrued flex account balances. In 2006, there were more than 30 IGFRs with positive flex account balances totaling approximately 40,000 acre-feet of flex credits. For more information on flexibility accounting, refer to the *Third Management Plan for the Prescott Active Management Area, 2000-2010*.

5.3.2 Agricultural Demands and Supplies

Historically, agriculture has been a large demand sector in the Prescott AMA. However, the number of irrigation acres and allotments decreased significantly between 1985 and 2006 to a total of 1,410 irrigation acres with an allotment of 4,753 acre-feet (*See Table 5-4*). Within the Prescott AMA, the majority of irrigated lands are located in the northern part of the AMA near the Town of Chino Valley and in the southern portion of the AMA along the Agua Fria River (*See Figure 5-5)*. There is one irrigation district within the Prescott AMA. Pasture, which tends to be deficit irrigated, is the predominant crop. Other crops include alfalfa, corn, small grains, and garden vegetables.

Table 5-4 Agricultural Total Water Use, Certified Irrigation Acres and Allotments By Irrigation Grandfathered Rights 1985, 1995, and 2006 Prescott Active Management Area

Year	Total Water Use	Groundwater Use	Certified Irrigation Acres	Allotments
1985	20,987	11,192	6,364	28,078
1995	17,745	5,331	6,079	27,263
2006	2,847	2,065	1,410	4,753

Note: All volumes are in acre-feet.

Between 1985 and 2006, approximately 60% of all IGFRs were partially or fully extinguished pursuant to the AWS Rules. This accounts for 3,678 acres in the Prescott AMA that can no longer be used for agricultural production. Extinguishment of these rights generated 134,495 acre-feet of extinguishment credits, of which 13,271 have been pledged and 121,224 have not been pledged to help meet the consistency with management goal criteria of proving a 100-year AWS. It is anticipated that a majority of the remaining IGFRs, particularly those that have not

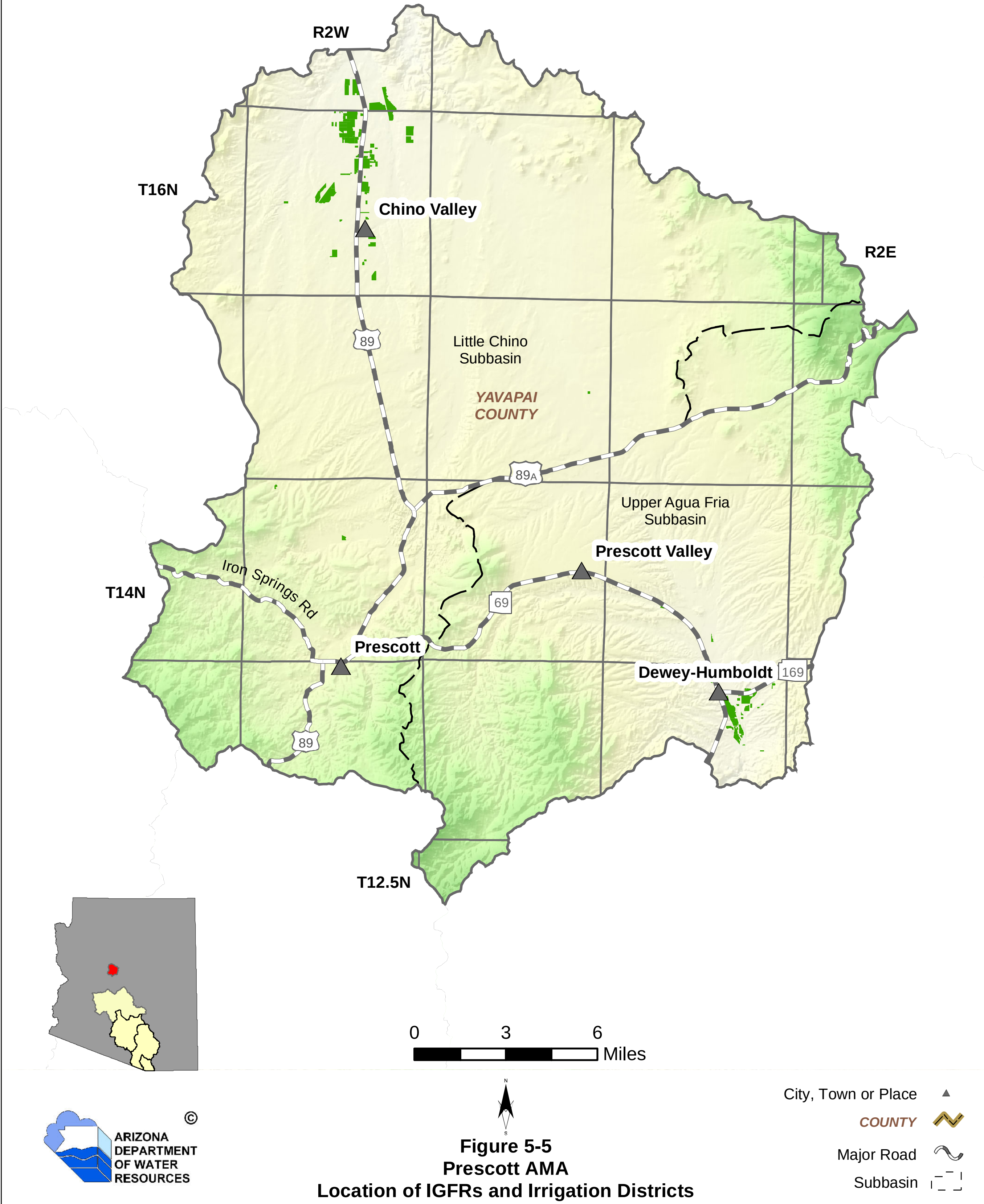


Figure 5-5
Prescott AMA
Location of IGFRs and Irrigation Districts

been utilized in recent years, will be extinguished in 2010 due to the provisions of AAC Rule R12-15-726 regarding calculation of extinguishment credits.

5.3.3 Non-Exempt IGFR Water Use Characteristics

Demand in the Agricultural sector accounted for almost 80% of the total water use in 1985. Since then, it has decreased significantly, accounting for only 12% of total water use in 2006. In 1985, water use in this sector was the highest demand year on record. The average from 1985 through 1995 was just over 14,000 acre-feet per year; the average from 1996 through 2006 was almost 6,700 acre-feet per year.

Demand and Supplies by District and Non-District

The *Chino Valley Irrigation District* (CVID) is the only irrigation district in the Prescott AMA. Historical information regarding CVID is somewhat limited because, as a purely surface water district, CVID was not required to report irrigation use. It is known that the district originally included approximately 2,500 acres of irrigated land (Gookin, 1977). In 1998, CVID entered into an intergovernmental agreement (IGA) with the City of Prescott in which CVID's surface water rights were relinquished to the City. Pursuant to the IGA, all CVID deliveries after 1999 are reclaimed water provided through recovery of reclaimed water. CVID did retain a small commitment to serve less than 30 acre-feet of surface water per year to three CVID properties. The maximum annual recovery limit under the IGA is 1,500 acre-feet until a total of 33,000 acre-feet have been recovered. CVID used approximately 3,200 acre-feet of surface water per year from 1985 to 1999. Many CVID shareholders hold their own IGFRs and have the ability to utilize groundwater in the future.

All other non-exempt uses are solely groundwater except for one IGFR that also holds surface water rights (*See Figure 5-6*).

5.3.4 Exempt IGFR Water Use Characteristics

In 1994, IGFRs less than 10 acres in size and not part of an integrated farming operation were exempted from conservation requirements and reporting obligations; therefore, their demand since 1993 is not known and can only be estimated.

From 1985 through 1993, an average of 40% of small rights in the Prescott AMA reported use each year. Small rights irrigated an average of 121 total acres per year during this period. Average annual use per acre was 1.51 acre-feet per acre. If this average rate of use were projected forward from 1993, it would result in less than 200 acre-feet of use by exempt Agricultural use. The actual use is probably much lower because approximately 60% of the exempt rights in the Prescott AMA have been extinguished. The water use reported for 1985 in Table *5-5* is actual use of all small rights. The data for 1995 and 2006 reflect water use as reported by non-exempt small rights, and deliveries to small rights within CVID boundaries as reported by CVID.

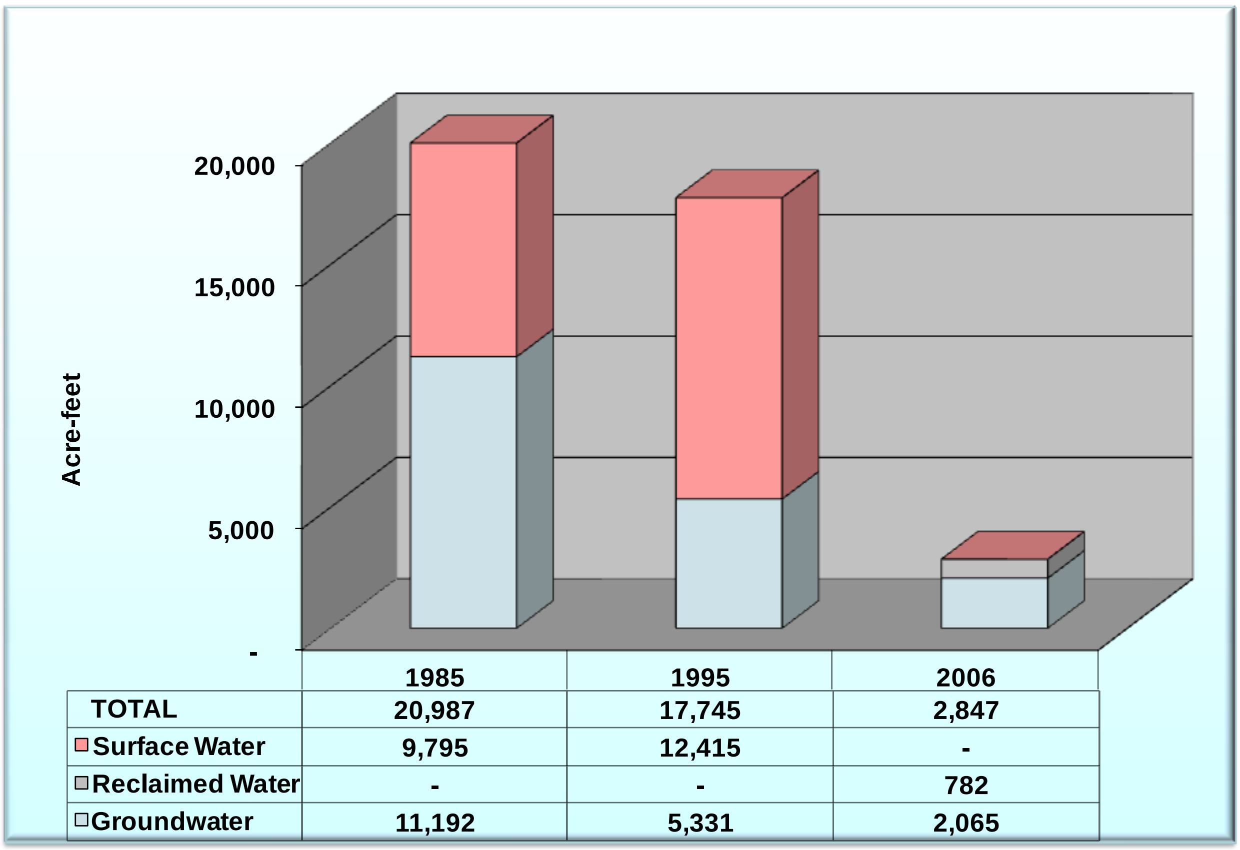
These farms rely entirely on groundwater pumped from private wells, or water delivered by CVID.

Table 5-5 *Agriculture Use by Exempt Irrigation Grandfathered Rights Total Water Use and Irrigation Acreage*

Year	Total Water Use	Groundwater Use	Certified Irrigation Acres
1985	522	199	446
1995	47	47	448
2006	93	93	27

Note: All volumes are in acre-feet.

Figure 5-6 Historical Agricultural Supplies, 1985, 1995, and 2006 Prescott Active Management Area



5.4 Indian Demands and Supplies

The Yavapai-Prescott Indian Reservation, located entirely within the Prescott AMA, covers approximately 1,400 acres within the City of Prescott. Approximately 180 members of the Yavapai-Prescott Indian Tribe (YPIT) live on the reservation (U.S. Census Burea, 2000). Historical water uses included timber, mining, and ranching. Current tribal uses are more business oriented. The YPIT operates the 12-acre Sundog Industrial Park, the 250-acre Frontier Village shopping center, and two gaming facilities - the Yavapai Bingo and Gaming Center and Bucky's Casino. The 160-room Prescott Resort and Conference Center is adjacent to Bucky's Casino (Inter Tribal Council of Arizona, Inc., 2003) (Northern Arizona University).

The YPIT received an original allocation of 500 acre-feet of CAP water, but the allocation was never used and was relinquished in 1994 pursuant to the Yavapai-Prescott Indian Tribe Settlement. The City of Prescott provided water to the YPIT prior to the settlement, and as a term of the settlement, agreed to provide water to the YPIT in perpetuity and to give the YPIT priority within their system. The YPIT retained up to 1,000 acre-feet of annual surface water rights from Granite Creek. Total annual water use of the YPIT is less than 200 acre-feet as estimated by the City of Prescott.

5.5 Artificial Recharge

Artificial recharge consists of artificial means of adding water to the aquifer, but it also results in the increased use of renewable water supplies, such as reclaimed water and surface water, over non-renewable groundwater by allowing for flexible and effective storage and recovery of renewable water supplies. For more information regarding the role of artificial recharge and the types of facilities used, refer to Section 3.3.

5.5.1 Underground Storage Facilities

Artificial recharge in the Prescott AMA is accomplished at USFs (*See* Figure *5-7)*, the first of which was permitted in 1994. Since 1998, reclaimed water and surface water have been recharged. Reclaimed water accounted for approximately 88 percent of water stored during the historical period; surface water accounted for the remaining 12 percent. The volume of water stored through 2006 is shown in Table *5-6*. All surface water that is recharged in the Prescott AMA is recovered annually. Recharge volumes and facilities for the years 1995, 2000, and 2006 were selected for three reasons: 1) recharge activity did not commence in most AMAs until approximately 1995; 2) data from 2000 provides an interim data point; 3) inclusion of data from 2006 completes data published for the entire state for that year.

Managed Facilities

From 2003 to 2007, the Town of Prescott Valley was permitted to operate a Managed USF that discharged reclaimed from their wastewater treatment facility (WWTF) into the Agua Fria River channel for in-channel recharge (*See* Figure *5-7)*. Storage occurred in only two years, 2003 and 2004, and included a 50% cut to the aquifer. A permit condition stated that this facility could not accrue any credits when storm flow was present in the Agua Fria River channel.

Constructed Facilities

In 2006, the Prescott AMA had three Constructed USFs with a combined permitted recharge volume of 10,081 acre-feet. The City of Prescott's recharge facility began operation in 1995, and was modified in 1998 to include surface water as a source. This facility recharges reclaimed water from the City of Prescott's WWTF and surface water from Granite and Willow Creeks through recharge basins. The Town of Prescott Valley's USF has operated since 2004 in the same location in the Agua Fria River channel as their Managed USF. They incorporated in-channel constructed berms into the river channel, thereby qualifying the facility as a constructed facility. This facility recharges reclaimed water from the Town of Prescott Valley's WWTF and, pursuant to permit conditions associated with storm flows within the facility, is often unable to accrue LTSCs. The Town of Chino Valley's Old Home Manor USF was permitted in 2006. This facility recharges reclaimed water from the Town of Chino Valley's WWTF through recharge basins and vadose zone wells.

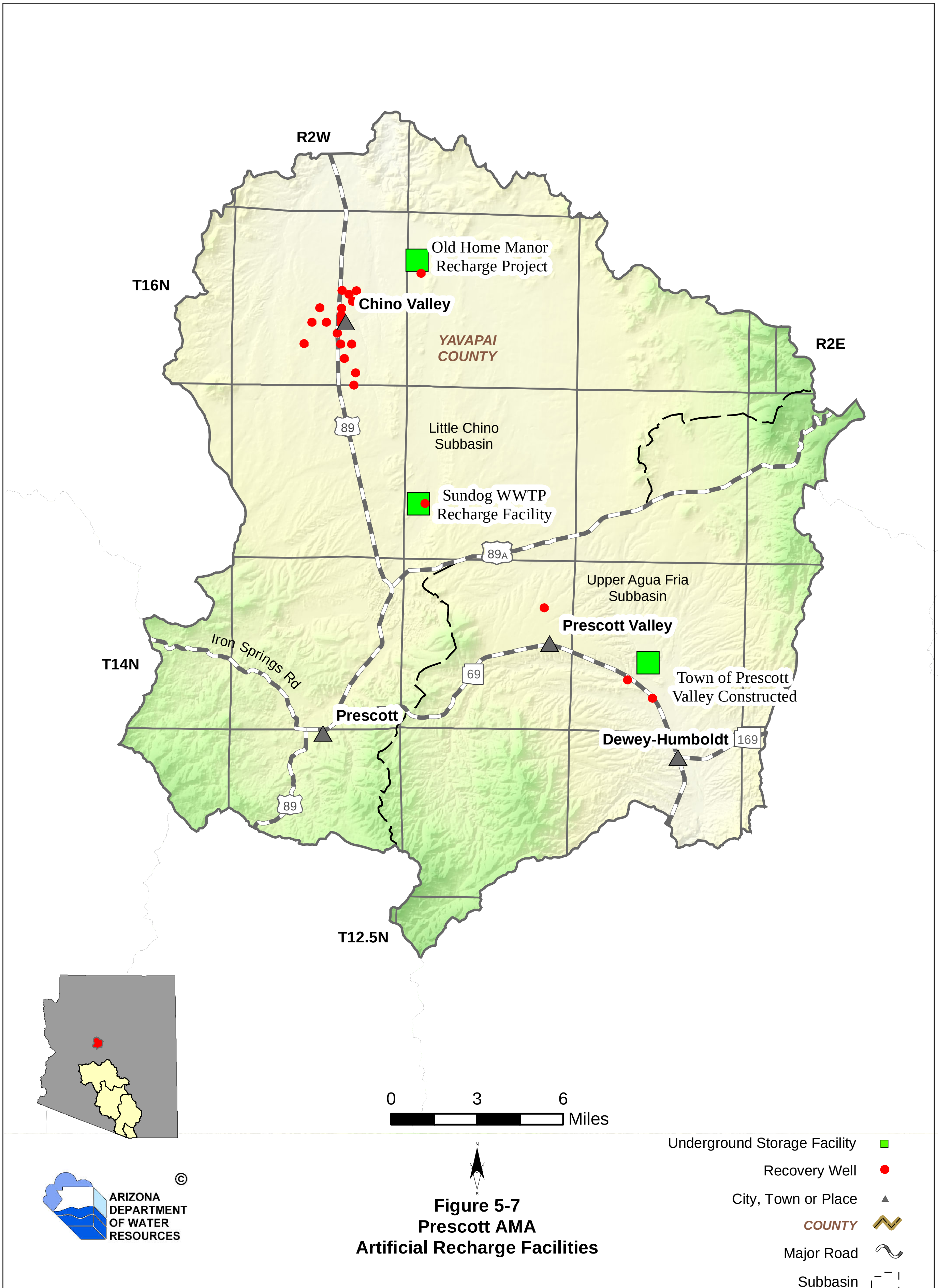


Figure 5-7
Prescott AMA
Artificial Recharge Facilities

Table 5-6 ***Artificial Recharge Volumes***
1985, 1995, and 2006
Prescott Active Management Area

Municipal Use Category	1995	2000	2006
Groundwater Savings Facility			
Number of Facilities	0	0	0
Underground Storage Facilities (Constructed)			
Number of Facilities	1	2	3
Reclaimed Water Stored	2,144	2,060	3,620
Surface Water Stored[1]		825	229
Total Stored (acre-feet)	**2,144**	**2,885**	**3,849**

[1]Annual recharge and recovery of surface water. All volumes are in acre-feet.

5.5.2 Credits Accrued Through 2006

Long-Term Storage Credits

In 2006, there were five long-term storage (LTS) accounts in the Prescott AMA. The City of Prescott annually recovers surface water that was recharged and, since 1999, has recovered a small volume from their LTS account for turf irrigation and municipal purposes. From 1999 to 2006, the average recovery from by City of Prescott was 70 acre-feet per year. The Towns of Chino Valley and Prescott Valley both have permitted recovery wells, but neither had recovered any credits as of 2006. CVID has recovered credits annually since 1999 for irrigation purposes. This recovery was pursuant to an IGA executed in 1998 between the City of Prescott and CVID, through which CVID relinquished their surface water rights to the city. Under the terms of the IGA, all CVID deliveries after 1999 are reclaimed water through recovery of credits transferred to CVID by the City of Prescott. The maximum annual recovery limit under the IGA is 1,500 acre-feet until a total of 33,000 acre-feet has been recovered. Through 2006, CVID had recovered 10,244 acre-feet of credits. In 2005 and 2006, North Nugget, LLC recovered a small volume of credits for municipal purposes to meet consistency with management goal requirements under a CAWS. The average recovery of credits by North Nugget, LLC was 6 acre-feet.

In the Prescott AMA, all credits are accrued through storage of reclaimed water. Through 2006, a total of 32,310 acre-feet of credits had been stored in the Prescott AMA and a total of 21,485 acre-feet of credits remained in storage (*See Table 5-7*).

Table 5-7 Artificial Recharge Credit Types and Amounts Through 2006
Prescott Active Management Area

Credit Type	Amount (acre-feet)
Long Term Storage Credits	
Underground Storage Facilities	3
Reclaimed water	32,310
Surface water	5,217
TOTAL	**37,528**
Extinguishment Credits	
Generated	134,495
Recovery	16,042
Credits Remaining in Storage	**21,485**

6. HISTORICAL TOTAL USE AND OVERDRAFT

6.1 Summary Budget

The following discussion considers historical total demands and groundwater overdraft in the Prescott AMA from 1985 to 2006, referencing three water-use years: 1985, 1995, and 2006. The Historical Summary Budget is shown in *Table 6-1* below. The basic budget components, and how they relate to the overdraft calculation, were discussed in further detail in Sections 3 and 4. Detailed water use figures for all years between 1985 and 2006 may be found at http://www.azwater.gov/AzDWR/WaterManagement/Assessments/default.htm.

Overdraft, depicted in *Table 6-1*, is the sum of the groundwater use for all three sectors, minus the sum of the incidental recharge values for the three sectors plus the additional offsets to overdraft (including net natural recharge and canal seepage). All Indian uses in the Prescott AMA are included within the Municipal sector. For purposes of this Assessment, overdraft is depicted in two values: 1) including the groundwater allowance volume in overdraft, to identify the physical impact of these withdrawals on the aquifer; and 2) excluding groundwater allowance volumes, in recognition that this volume of groundwater is considered to be consistent with the management goal under the AWS Rules.

6.1.1 Demand

In 1985, total demand for the water using sectors (Municipal, Industrial, and Agricultural) in the Prescott AMA was 26,377 acre-feet. Agricultural uses accounted for almost 80 percent of total demand in the Prescott AMA; Municipal uses accounted for approximately 18 percent. From 1985 to 2006, demand in the Municipal sector increased sharply while Agricultural demand over the same period dramatically decreased. The period between 1995 and 2006 showed the most dramatic increases in Municipal use and the most dramatic decreases in Agricultural demand. Industrial use increased between 1985 and 2006 but never accounted for more than 8 percent of total AMA demand.

Table 6-1 Historical Summary Budget and Overdraft
1985, 1995 and 2006
Prescott Active Management Area

SECTOR	CATEGORY	1985	1995	2006
Municipal		4,749	10,380	19,015
Demand	*Municipal Providers*	4,004	9,137	14,843
	Exempt Wells	745	1,244	2,069
Supply	*Municipally Provided Groundwater*	3,794	9,137	14,843
	Exempt Well Groundwater	745	1,244	2,069
	Surface water	210	0	229
	Reclaimed water	0	0	1,875
	Incidental Recharge	0	0	0
Industrial				
Demand		641	696	1,486
Supply	*Groundwater*	641	696	1,360
	Surface water	0	0	126
	Incidental Recharge	36	71	133
Agricultural				
Demand		20,987	17,745	2,847
Supply	*Groundwater*	11,192	5,331	2,065
	Surface water	9,795	12,415	0
	Reclaimed water	0	0	782
	Incidental Recharge	8,109	6,223	1,423
Other				
Demand	*Cuts to the aquifer*	0	0	0
Supply	*Net Natural Recharge*	1,700	6,849	1,700
	Canal Seepage	1,988	1,346	0
GW use not counted towards overdraft	*GW Allowance*	0	0	7,937
Overdraft	**Subtracting GW Allowance**	**4,539**	**1,918**	**9,144**
	Without Subtracting GW allowance	**4,539**	**1,918**	**17,081**

Note: All volumes are in acre-feet. In the Prescott AMA, the groundwater allowance can change annually (See 5.1.3).

6.1.2 Supply

In 1985, groundwater was the primary supply used to meet demands in the Prescott AMA, with surface water supply only being utilized to meet Agricultural demand. Non-groundwater supplies available within the Prescott AMA are reclaimed and surface water. Between 2000 and 2006, the City of Prescott was the only provider with the authority to utilize surface water and they used an average of less than 800 acre-feet per year. The use of reclaimed water began in 2000 and between 2000 and 2006, an annual average of approximately 1,750 acre-feet were utilized. In 2006, groundwater accounted for 87 percent of supply; reclaimed water accounted for 11 percent and surface water for the remainder.

6.1.3 Offsets to Overdraft

The various offsets to overdraft for the historic period, as explained in more detail in Section 3.4, are listed in *Table 6-2* below.

Table 6-2 Offsets to Overdraft
1985, 1995, and 2006
Prescott Active Management Area

TYPE OF OFFSET	1985	1995	2006
Incidental Recharge			
Industrial	36	71	133
Agricultural	8,109	6,223	1,423
Net Natural Recharge	1,700	6,849	1,700
Canal Seepage	1,988	1,346	0
Cuts to the Aquifer	0	0	0
Total	**11,833**	**14,489**	**3,256**

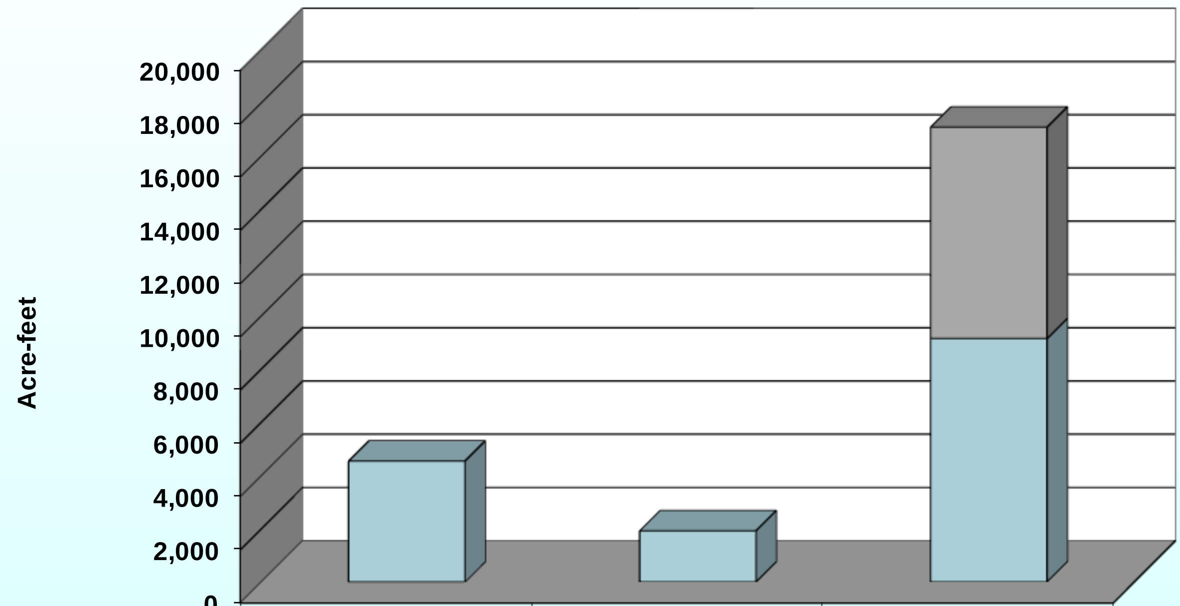
Note: All volumes are in acre feet.

6.2 Historical Overdraft

Figure *6-1* displays historical overdraft in the years 1985, 1995 and 2006. The 2006 overdraft volume includes both the overdraft with and without the groundwater allowance included. Although groundwater allowance pumping is indeed groundwater that is not being replenished, it is allowable pumping under the AWS Rules. As described in Section 3.4.4, the groundwater allowance component to the AWS Rules illustrates a policy decision that was made to allow for growth, flexibility, and transition to the AWS Rules requirements.

Most withdrawal authorities do not have a replenishment requirement. These authorities include IGFRs, Type 1 and Type 2 rights, groundwater withdrawal permits, exempt domestic wells, and service area rights operated by undesignated municipal providers who serve customers not covered by a CAWS issued after 1995. Groundwater pumped pursuant to these types of withdrawal authorities applies directly to groundwater overdraft because no replenishment is required.

Figure 6-1 ***Historical Estimated Overdraft***
1985, 1995 and 2006
Prescott Active Management Area



	1985 Historical	1995 Historical	2006 Historical
TOTAL	4,539	1,918	17,081
GW ALLOWANCE	-	-	7,937
OVERDRAFT	4,539	1,918	9,144

6.3 Major Factors that Affected Historical Overdraft

The year 1985 provides a backdrop for the overdraft discussion as it was the second year in which major water users in the Prescott AMA were required to measure and report withdrawals and use of water. At this time, overdraft - the amount of groundwater being withdrawn in excess of the amount being recharged naturally or artificially – was just over 4,500 acre-feet (*See* Figure *6-1).*

Prior to 1989, the overdraft in Prescott AMA was relatively low, averaging approximately 4,300 acre feet. Historically, irrigation was the primary use sector and surface water supplied by the CVID was a primary source of irrigation water for the AMA's agricultural lands. The canal system operated by the CVID was relatively inefficient because the main canal and distribution canals were not lined. Losses from this canal system recharged a large volume of water to the aquifer, which offset a great deal of pumpage. In 1993, 1995, and 2005, increased flood flows produced near safe-yield or safe-yield conditions.

From 1994 through 1998, AMA overdraft increased above the previous historical average. This shift away from safe-yield was a result of decreasing agricultural use within the CVID, an overall decrease in agricultural use within the AMA, and increased use by the municipal sector. Between 1985 and 1992, the demand for the municipal sector averaged just over 6,700 acre-feet; between 1994 and 1998, it averaged over 11,500 acre-feet - an average increase of over 60 percent in only six years.

Two significant events occurred in 1999: the completion of the sale of CVID's surface water rights to the City of Prescott, and the declaration that the Prescott AMA was out of safe-yield. The sale of CVID's surface water rights has resulted in a decrease in agricultural water use within the CVID boundaries. Pursuant to the IGA between CVID and the City of Prescott, the maximum volume of credits that can be conveyed to CVID in any year is 1,500 acre-feet. Although there are stakeholders within CVID with IGFRs, the total agricultural demand within the AMA decreased 5,719 acre-feet or 67 percent between 1999 and 2006.

CAWS issued after the declaration must meet the consistency with goal criteria, however CAWS issued prior to the declaration date are not required to meet the safe-yield goal criteria. This means that those subdivisions can continue to rely on groundwater pumping as their source of supply in perpetuity. To date, the build-out demand of the pre-declaration CAWS is much greater (5,807 acre-feet) than the build-out demand of post-declaration CAWS (362 acre-feet). Over time, new demand will exceed the pre-declaration demand; however, the 5,807 acre-feet of pre-declaration demand will continue to deplete the Prescott AMA's groundwater supply within the existing regulatory framework.

Reclaimed water was not a significant source of supply in the Prescott AMA from 1985 through 2006. It is anticipated that artificial recharge of reclaimed water will play an important role in meeting the safe-yield management goal by making recovered reclaimed water a viable alternative to groundwater. Pursuant to the AWS Rules, development associated with CAWS and DAWS must prove water supplies for 100 years; most or all of that water must be from renewable sources. Renewable supplies are limited within the Prescott AMA, and recovered reclaimed water is one of few alternatives to groundwater available for these purposes. The physical act of artificial recharge does not contribute to reaching the safe-yield goal because none of the recharge done in the Prescott AMA provides a benefit to the aquifer. Although underground storage and recovery is an important management tool, its primary impact to the water budget will ultimately be through supply side reductions.

PART IV PROJECTED WATER USE AND OVEDRAFT

7. INTRODUCTION TO THE PROJECTIONS

7.1 Purpose and Approach for Projecting Demands

Part III, Historical Water Demand and Overdraft, describes the status of the current imbalance or groundwater overdraft. In order to determine if the Prescott AMA will achieve the statutory goal of safe-yield by 2025, future demand, supply utilization and groundwater overdraft must be projected. ADWR recognizes for this Assessment that planners and decision makers need to move away from expectations of perfect or near-perfect forecasts (Arizona State University, 2009). Instead, ADWR, in consultation with outside entities, has developed seven different scenarios, each with slightly different assumptions.

This Assessment contains three baseline scenarios, three additional shortage scenarios incorporating possible climate change impacts, and one scenario that maximizes the utilization of groundwater transported into the AMA from the Big Chino Sub-basin. As defined by the Intergovernmental Panel on Climate Change, "*A scenario is a coherent, internally consistent and plausible description of a possible future state of the world. It is not a forecast; rather, each scenario is an alternative image of how the future can unfold.*" The Sustainability of semi-Arid

Hydrology and Riparian Areas (SAHRA) website for Scenario Development further explains scenarios as

> *"Descriptions of possible alternatives of the future that take into account the interaction of many different components of a complex system. Although scenarios are not forecasts or even predictions of the most-likely alternatives, they provide a dynamic view of the future by exploring various trajectories of change that lead to a number of possible alternative futures. Because unique and unanticipated conditions have more chances to occur over a long period of time, long-term scenarios have more uncertainty than short-term scenarios"* (Sustainability of semi-Arid Hydrology and Riparian Areas, 2009).

Recognizing that it is impossible to predict accurately what future demand will be, staff developed a plausible range of demand and overdraft scenarios up to and including the year 2025. Baseline Scenario One represents the lowest reasonable water demand, Baseline Scenario Three the highest reasonable water demand, while Scenario Two is a mid-level projection. None of the baseline scenarios incorporate changes in surface water supply as a result of climate change.

Debate continues over climate change; will it occur, and to what extent? Several climate change models exist for the southwestern region of the United States, but at this time, are not localized enough to be useful for the purposes of this Assessment. However, ADWR could not ignore the potential effects of climate change, so an effort was made to incorporate a period of reduced surface water availability based on a similar historical occurrence in the three climate change scenarios. Assumptions behind these additional scenarios, and the impact on groundwater overdraft, are described in Section 14.1.

The seventh and final scenario developed for this Assessment is the Maximized Transportation of Groundwater from the Big Chino Sub-basin Scenario. This scenario incorporates the maximum volume of groundwater that can be legally transported into the AMA by cities and towns. This scenario recognizes that utilization of transported groundwater may be one of the only ways to achieve safe-yield in the Prescott AMA by 2025 (*See Section 14.2*).

The scenarios developed by ADWR for this Assessment are one set of potential results in terms of projecting future demand and groundwater overdraft. Part of the work that went into the compilation of this Assessment was the creation of a centralized data repository for the historical supply and demand information. This central repository was designed with the intent to provide ADWR with a flexible and readily updateable database that is directly connected to multiple future demand and supply scenarios. This will allow ADWR to quickly update annual report information on the demand side along with continual updates of supplies and future assumptions as conditions change.

7.1.1 Water Demand Projection Techniques

For the purposes of this Assessment, staff used three methods to project demands: the per capita or per unit water use approach; the time-series approach (a sequence of data points, measured at successive times spaced at uniform time intervals in order to forecast events based on known past events); and the regression analysis approach (a statistical tool for investigation of the relationship between variables – also sometimes referred to as the econometric approach).

For Municipal demand estimates, the Gallons Per Capita Per Day (GPCD) rate was multiplied by the population projection. The time-series approach was employed to statistically analyze the historical water use trend line to project future demand trends based on historical trends.

The Industrial and Agricultural projected demands generally resulted from this technique. Finally, the regression analysis approach utilized the Coefficient of determination (the square of the sample correlation coefficient between the outcomes and their predicted values, varying from 0 to 1) to analyze water use related to influencing factors such as demographic changes, climate changes, and socio-economic changes. This allowed staff to estimate parameters that measure the historical relationship between water use (dependent variable) and different factors (explanatory variables or independent variables), assuming that those parameters will continue into the future.

8. PROJECTED DEMANDS AND OVERDRAFT

8.1 Projected Summary Budget

The three baseline scenarios correspond generally to low, medium, and high AMA projected demands, according to sets of assumptions assembled for each water use sector. In some cases, the assumptions used to project supplies also varied among the three baseline scenarios. The methodology and assumptions used in projecting the future water use of the Municipal, Industrial, and Agricultural water use sectors under these three baseline scenarios are described in detail in Sections 9 through 11.

Incidental recharge is calculated as a percentage of the demand for each water use sector. Incidental recharge rates are based on the water use sector and nature of the water use (*See Table 3-3*). The Projected Summary Budget includes net natural recharge on an AMA-wide basis.

ADWR has assigned certain volumes of groundwater for use by water providers with a DAWS and for subdivisions with a CAWS. The groundwater allowance is discussed further in Section 3.4, Offsets to Overdraft, in the Historical portion of the Assessment. In the Projected Summary Budget, projected overdraft in year 2025 is displayed in two ways: with groundwater allowance pumping subtracted from the overdraft calculation and with it included in the overdraft calculation (*See Table 8-1*). The amount of allowable groundwater pumped, which is the difference between the two sets of overdraft figures, ranges from 10,219 acre-feet in Scenario Two to 10,695 acre-feet in Scenario Three.

Table 8-1 2025 Projected Summary Budget – Baseline Scenarios
Prescott Active Management Area

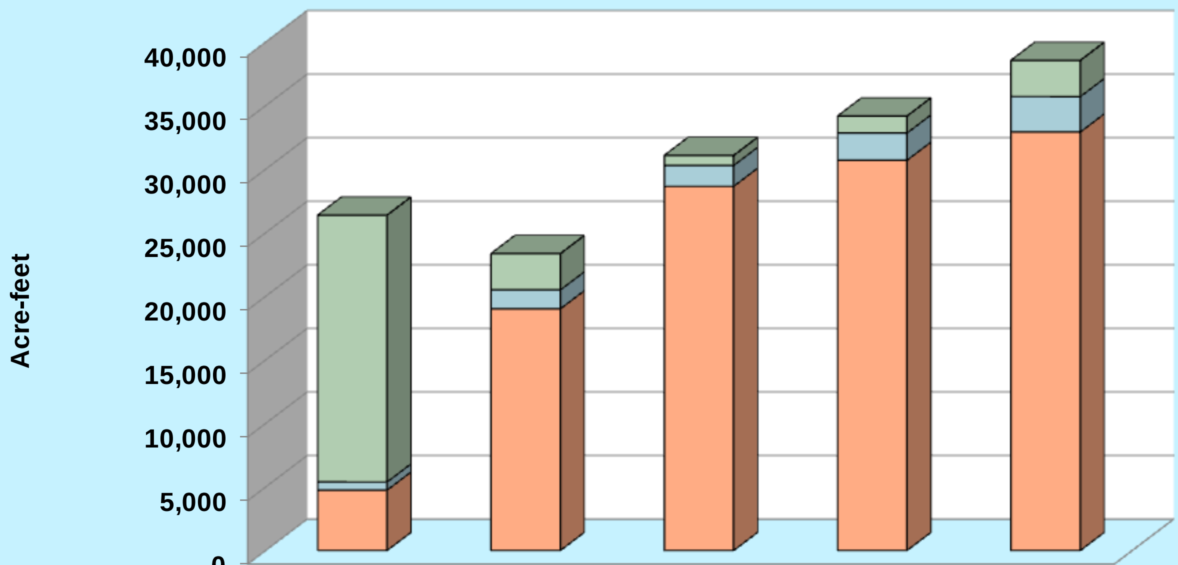
SECTOR	CATEGORY	Baseline Scenario One	Baseline Scenario Two	Baseline Scenario Three
Municipal				
Demand		28,651	30,703	32,921
	Municipal Providers	24,897	26,099	27,984
	Exempt Wells	3,754	4,604	4,936
Supply	*Municipally Provided Groundwater*	19,568	19,189	19,796
	Exempt Well Groundwater	3,754	4,604	4,936
	Surface water	1,335	1,335	1,335
	Reclaimed water	3,994	5,575	6,853
Industrial				
Demand		1,640	2,140	2,784
Supply	*Groundwater*	1,505	2,005	2,649
	Surface water	135	135	135
	Incidental Recharge	157	217	273
Agricultural				
Demand		783	1,329	2,847
Supply	*Groundwater*	33	579	2,065
	Reclaimed water	750	750	782
	Incidental Recharge	392	664	1,423
Other				
Offsets to Overdraft	Net Natural Recharge	4,000	4,000	4,000
	Canal Seepage			
Groundwater use not counted towards overdraft	*GW Allowance*	10,564	10,219	10,695
Overdraft	**Subtracting GW Allowance**	**9,748**	**11,276**	**13,055**
	Without Subtracting GW allowance	**20,312**	**21,495**	**23,750**

All values are in acre-feet.

8.1.1 Demand Range

Total projected 2025 demand ranges from 31,074 acre-feet in Scenario One, to 38,552 acre-feet in Scenario Three (*See Figure 8-1*). Generally, the difference in Municipal demand between the three baseline scenarios is due to a combination of assumptions regarding future population growth and corresponding water use. The difference in Agricultural demand in the three baseline scenarios generally reflects the retirement of irrigation acres and the extinguishment of irrigation rights. In all scenarios, there was an assumption that irrigation would continue within CVID pursuant to the provisions of the intergovernmental agreement between the City of Prescott and CVID. The difference in Industrial demand figures are due to differences in assumptions regarding new turf-related facilities and new uses in the other category. The assumptions and methodology used for water demand projections are detailed in Sections 9 through 11.

Figure 8-1 Historical and 2025 Projected Demand by Sector
Prescott Active Management Area

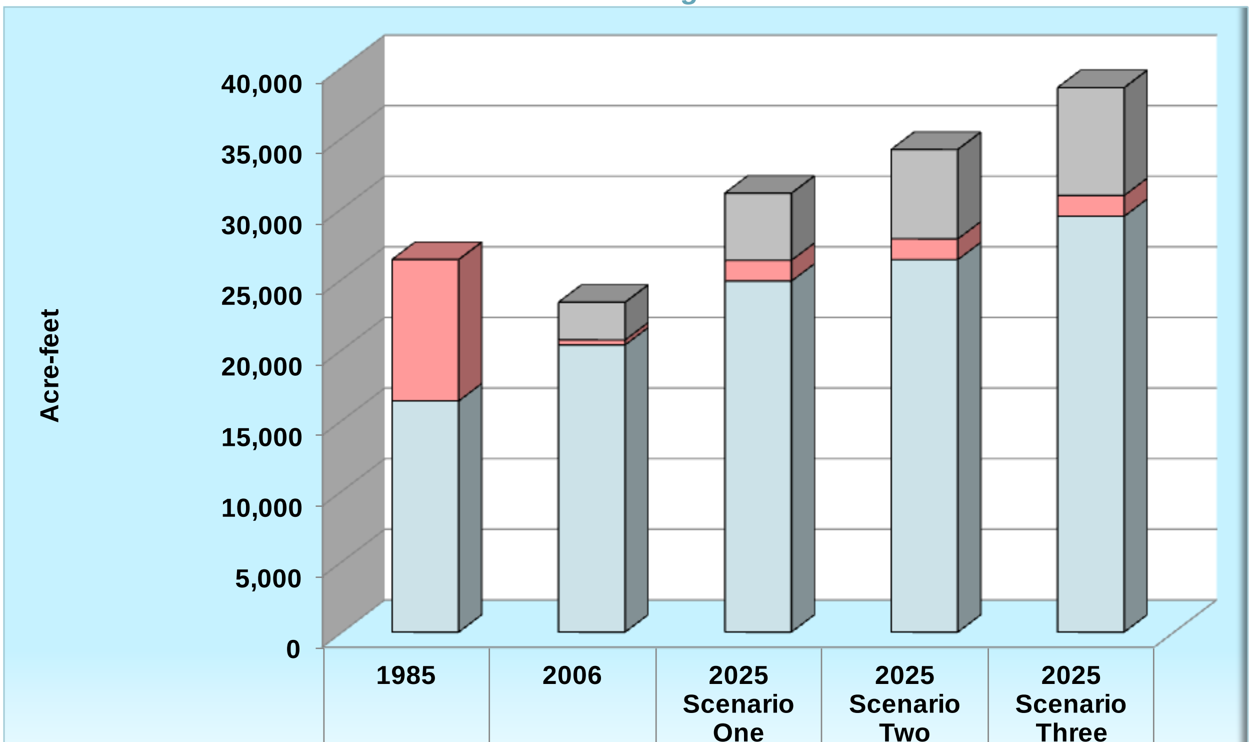


	1985	2006	2025 Scenario One	2025 Scenario Two	2025 Scenario Three
TOTAL	26,377	23,348	31,074	34,172	38,552
AGRICULTURAL	20,987	2,847	783	1,329	2,847
INDUSTRIAL	641	1,486	1,640	2,140	2,784
MUNICIPAL	4,749	19,015	28,651	30,703	32,921

8.1.2 Supply Range

The total projected supplies used to meet demand are shown in *Figure 8-2*. Historically, groundwater was the primary source of supply utilized to meet Municipal demand and surface water provided by the CVID was the primary source of supply utilized to meet Agricultural demand. After 1999, surface water ceased to be a supply for Agricultural demand; however the baseline scenarios include an approximately equal volume of surface water that is utilized by the City of Prescott through annual recharge and recovery. There is little variation between the volume of groundwater and surface water in the baseline scenarios. This is primarily due to the limits associated on use of surface water through annual recharge and recovery; the City of Prescott does not have a surface water treatment facility. Each scenario utilizes nearly 80 percent groundwater, with the increased demand in Scenarios Two and Three being met with reclaimed water.

Figure 8-2 Historical and 2025 Projected Supplies
Prescott Active Management Area



	1985	2006	2025 Scenario One	2025 Scenario Two	2025 Scenario Three
TOTAL	26,377	23,349	31,074	34,172	38,552
RECLAIMED WATER	0	2,657	4,744	6,325	7,635
SURFACE	10,005	355	1,470	1,470	1,470
GROUNDWATER	16,372	20,337	24,860	26,376	29,447

8.1.3 Offsets to Overdraft

There are two factors, as shown in *Table 8-2*, that offset groundwater pumping. As mentioned previously, incidental recharge results from sector water use activities such as water applied to fields in excess of crop consumptive use and evaporation demands within the Agricultural sector, or a similar application of water to Industrial turf-related facilities. Incidental recharge rates are assumed to be consistent with historical rates, depending on the water use sector and nature of the water use.

Net natural recharge in the Prescott AMA consists of a number of factors: mountain front recharge; flood recharge along Granite Creek, Lynx Creek and Mint Wash; groundwater discharge as base flow of the Agua Fria River; groundwater discharge as spring flow at Del Rio Springs; and groundwater discharge out of the Little Chino Sub-basin as subsurface flow. In all baseline scenarios, net natural recharge is estimated to be a constant 4,000 acre-feet based on inputs of 8,100 acre-feet and outflows of 4,100 acre-feet. The input value of 8,100 acre-feet was derived based on available data indicating that there is at least a 90% chance that at least 8,100 acre-feet of natural recharge will occur within any given 10-year period. For additional discussion regarding net natural recharge in the Prescott AMA see Section 3.4.1.

Table 8-2 2025 Projected Offsets to Overdraft
Prescott Active Management Area

TYPE OF OFFSET	Scenario One	Scenario Two	Scenario Three
Incidental Recharge			
Industrial	157	217	273
Non-Indian Agricultural	392	664	1,423
Net Natural Recharge	4,000	4,000	4,000
Total	**4,549**	**4,881**	**5,696**

Note: All volumes are in acre-feet.

8.2 Overdraft Range

In 2006, the estimated overdraft for the Prescott AMA was approximately 17,080 acre-feet. The projected 2025 overdraft figures vary from 20,312 acre-feet in Baseline Scenario One to 23,750 acre-feet in Baseline Scenario Three (*See Figure 9-1*).

As detailed earlier in this Assessment, a portion of this overdraft is groundwater allowance under the AWS Program, and is deemed to be consistent with the management goal of the Prescott AMA. If allowable groundwater is not included, there remains a projected overdraft in the range of 9,748 to 13,055 acre-feet in 2025.

It should be noted again that in addition to the AWS Program groundwater allowance, certain users are legally permitted to withdraw groundwater pursuant to groundwater rights and withdrawal authorities that do not have a replenishment requirement. These withdrawal authorities include IGFRs, Type 1 and Type 2 rights, groundwater withdrawal permits, exempt wells, and service area rights operated by undesignated municipal providers who serve customers not covered by a CAWS. Groundwater pumped pursuant to these types of withdrawal authorities is included as overdraft and continues to be an impediment to reaching safe-yield because no replenishment is required.

9. MUNICIPAL PROJECTIONS

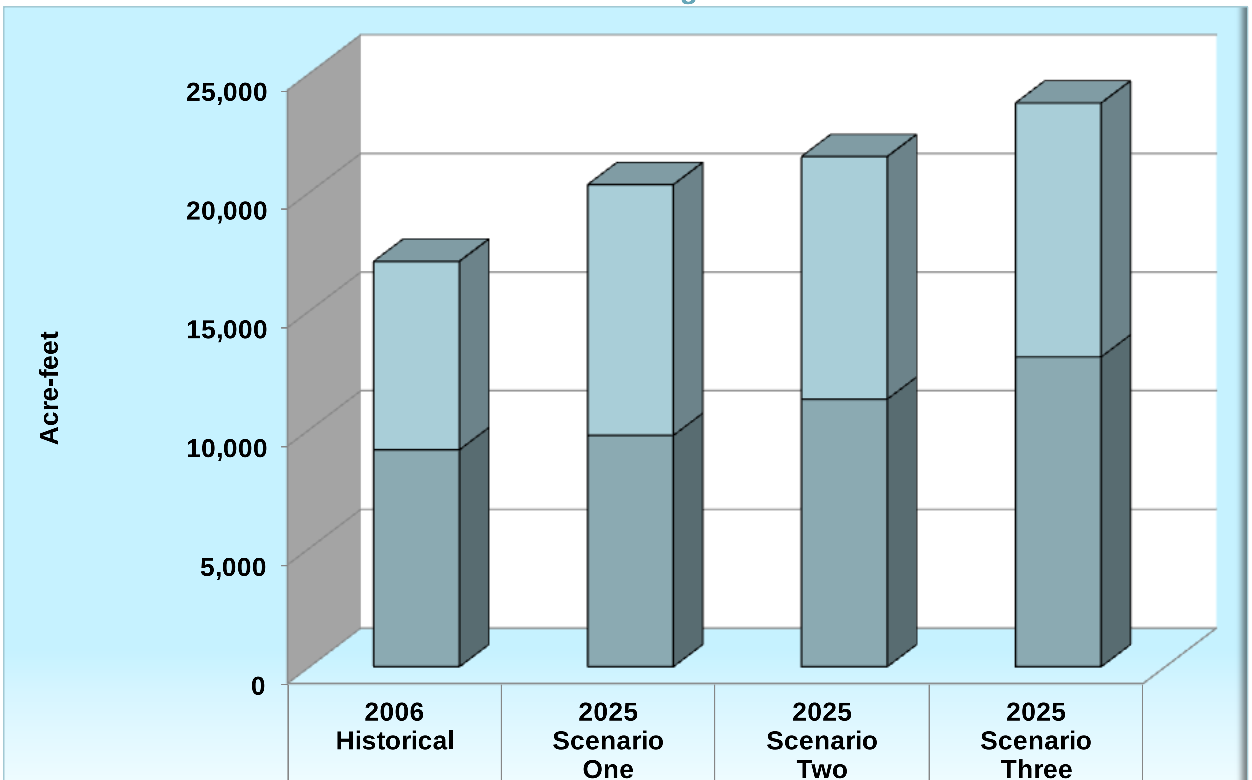
Generally, the highest population projection was paired with the highest water demand projection method and the lowest population projection was paired with the lowest demand projection method. This established the end points of the range of projected municipal population and demand. A third scenario fell between the highest and the lowest scenarios (*See Figure 9-2*).

9.1 Description of Demand Methodologies and Assumptions

9.1.1 Population

Projecting Municipal demand begins with population. Some Industrial subsector demand is also directly related to population. This is discussed further in the Industrial projection section. Various methods of projecting population that incorporated multiple steps were used for this Assessment. Some of the scenarios used all the steps, and others did not. Methods used include:

Figure 9-1 2025 Projected Overdraft
Prescott Active Management Area



	2006 Historical	2025 Scenario One	2025 Scenario Two	2025 Scenario Three
TOTAL	17,081	20,312	21,495	23,750
GW ALLOWANCE	7,937	10,563	10,219	10,695
OVERDRAFT	9,144	9,748	11,276	13,055

- *Population projections prepared by the Arizona Department of Commerce* were used to develop a total Prescott AMA population projection.
- A *calculated total AMA population* was developed using different methods for large providers, small providers, and exempt wells:

  - *Simple statistics* were used to project population for each individual large municipal provider that does not hold a DAWS. (For designated providers, the projected population and demand included in the provider's DAWS was used.) Trend lines with the highest statistical correlation were selected for each undesignated provider. The trend lines used data from 1985 through 2006. In some cases, water providers submitted population projections to ADWR that extended for some years beyond 2006 but did not extend out to 2025. ADWR used the providers' projections for as many years as were given, and extended the projections to 2025 with statistical trend lines.

  - The small provider and exempt well sub-sector populations were projected using an *average percent growth rate or average number of people added per year growth rate*. The period used to generate the growth rate varied by scenario, but was either from 1985 to 2006 or from 2000 to 2006.

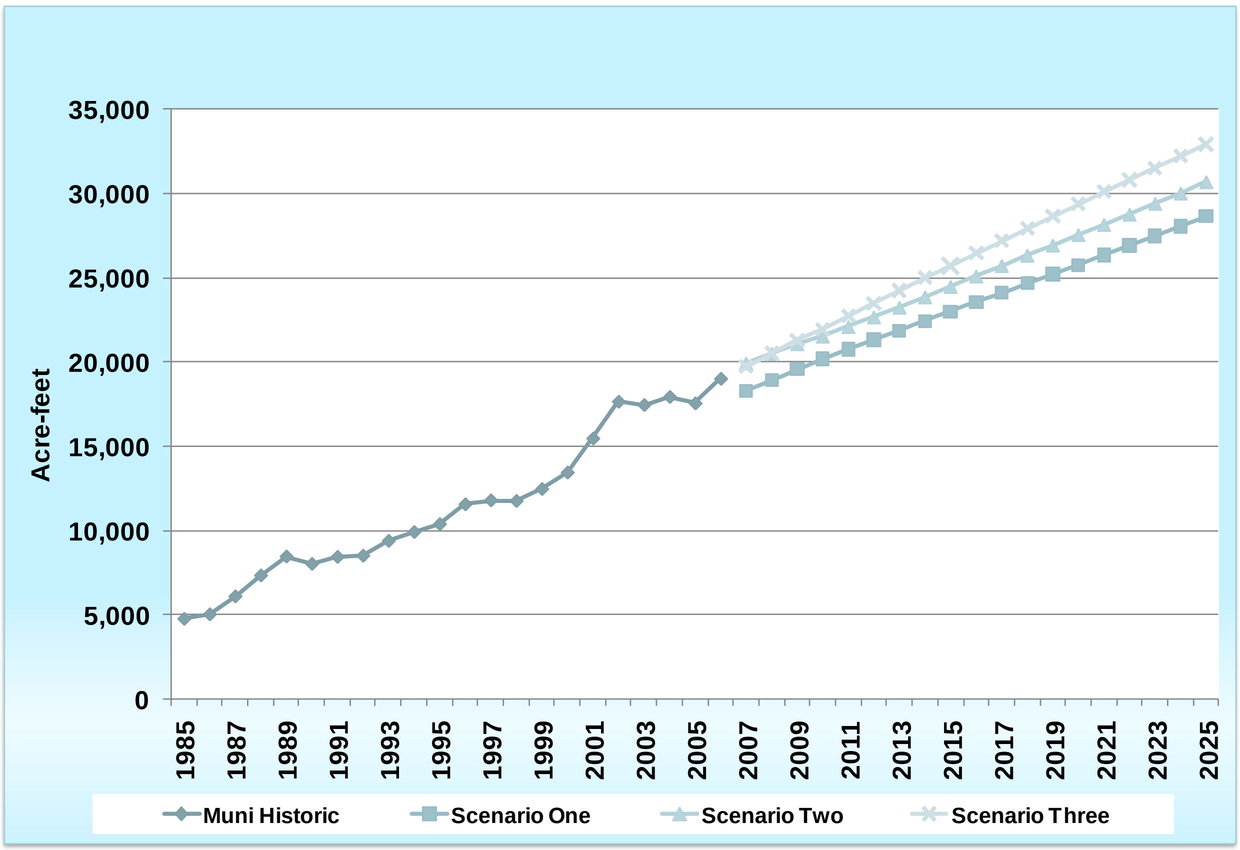
- Using these methods, the projections for large providers, small providers, and exempt wells were summed to develop a *calculated total AMA population*.

The methods were compared and categorized from lowest to highest. Appendices 1 though 4 describe the individual Municipal assumptions for the Prescott AMA in more detail.

9.1.2 Designations of Assured Water Supply

The City of Prescott holds a DAWS and has provided ADWR with projected water demand and projected population in their application for DAWS and in their annual reports. ADWR used this information because the determinations of AWS for this provider is based on this information, which is tracked using data provided in the annual reports.

Figure 9-2 Projected Municipal Water Demand
Prescott Active Management Area



9.1.3 Baseline Scenario One Demand Methodology and Assumptions

Baseline Scenario One uses the Department of Commerce projections to develop an overall AMA total population. Large provider population projections are from the provider's DAWS or based on trend line analysis. *The Third Management Plan for Prescott Active Management Area 2000-2010* conservation requirement calculation methodology was used with the population projection for each large provider to calculate the projected Baseline Scenario One demand for each large provider (*See Table 9-1*).

Table 9-1 2025 Projected Municipal Water Demand
Prescott Active Management Area

Municipal Use Category	Scenario One	Scenario Two	Scenario Three
Large Providers			
Total Use	23,062	24,199	25,944
Groundwater Use	17,733	17,288	17,756
Small Providers			
Total Use	1,835	1,900	2,041
Groundwater Use	1,835	1,900	2,041
Domestic Exempt Well Use			
Total Use	3,754	4,604	4,936
Groundwater Use	3,754	4,604	4,936
AMA Total Use	**28,651**	**30,703**	**32,921**
AMA Total Groundwater Use	**23,332**	**23,793**	**24,733**

Note: All volumes are in acre-feet.

For small providers in Baseline Scenario One, the average rate of growth of small provider population from 1985 through 1999 was used. Small provider demand was projected using the 1985 to 2006 average small provider GPCD rate multiplied by the benched small provider population.

Baseline Scenario One projects exempt well population as the remainder of the Department of Commerce projection for the entire AMA after the projection for large providers and small providers are subtracted out. Demand from exempt domestic wells is 90 GPCD. For additional information, see Section 5.1.5.

9.1.4 Baseline Scenario Two Demand Methodology and Assumptions

Baseline Scenario Two uses the same population projection as Baseline Scenario One for large providers, but calculates demand using the DAWS demand for City of Prescott and the 2000 to 2006 average GPCD rate for the Town of Prescott Valley (*See Table 9-1*).

Small provider population is the same as in Baseline Scenario One; however, demand for small providers in Baseline Scenario Two is calculated using the 2000 to 2006 average GPCD rate.

The population using exempt domestic wells is calculated using an average historic growth rate. The demand for exempt domestic wells is calculated using 90 GPCD.

9.1.5 Baseline Scenario Three Demand Methodology and Assumptions

Baseline Scenario Three population projections occurred in a step-wise manner. First, a total AMA population was projected for each year from 2007 - 2025 utilizing the 2000-2006 average number of people added to the AMA per year obtained from the historic budget template data for the Prescott AMA. Then, the percentage difference between this population and the total AMA population under Scenario Two was calculated. This percentage difference was then used to annually increase the population of large and small providers, and the population receiving domestic water from exempt wells (See Table 9-1).

Demand for both the City of Prescott and Town of Prescott Valley in Baseline Scenario Three is calculated in the same manner as for Baseline Scenario Two.

Similarly, small provider demand in Baseline Scenario Three was calculated in the same manner as for Baseline Scenario Two.

Exempt domestic well population and demand for Baseline Scenario Three was calculated in the same manner as Baseline Scenarios One and Two.

9.2 Description of Supply Methodology and Assumptions

Individual supply assumptions were made for the City of Prescott based on the DAWS and for the Town of Prescott Valley based on historical use of supplies, with renewable supplies capped based on treatment capacity limitations, underground water storage, or recovery limitations. It is assumed that the City of Prescott will use their renewable supplies to the fullest extent feasible as indicated on their DAWS. Groundwater allowance and surface water would be used as necessary by the City of Prescott to maintain the DAWS. Use of reclaimed water gradually increases *(See Figure 9-3)* because all new subdivisions after 1999 must comply with the consistency with management goal requirement of the AWS Rules by utilizing their renewable water supplies and through use of the groundwater allowance.

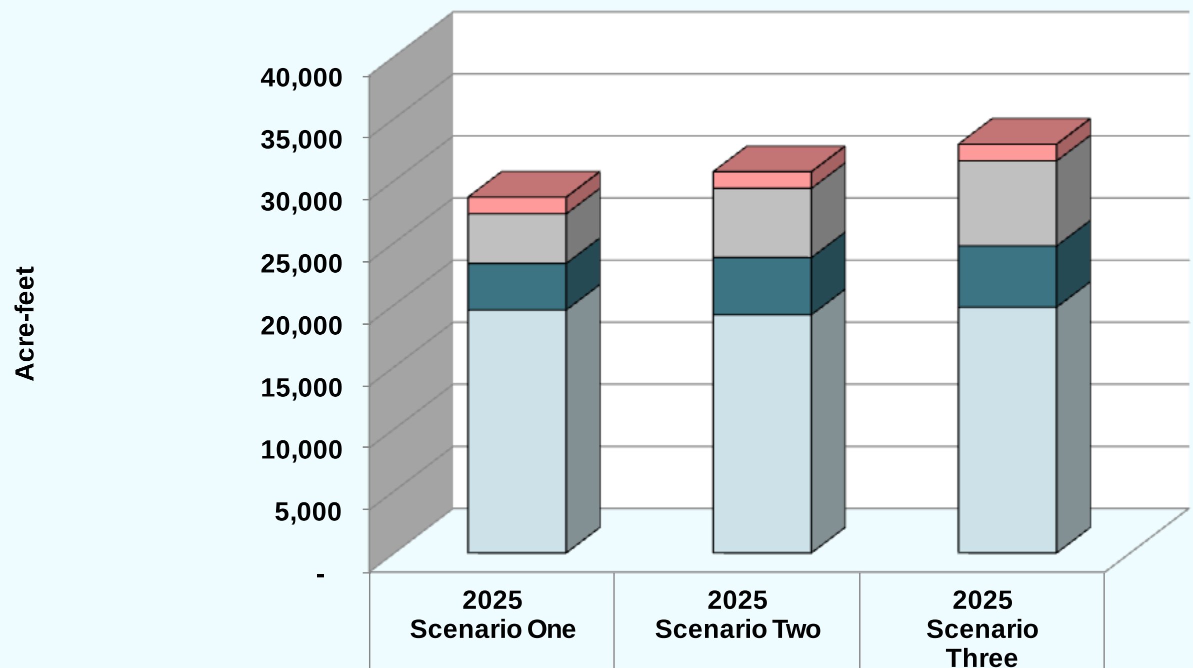
Small providers and exempt domestic well populations use only groundwater in all three baseline scenarios.

9.3 Overview of Municipal Results

Although the recent reduction in residential construction due to current economic conditions has not been accounted for in any of the three baseline scenarios, the Municipal sector represents significant potential demand in the Prescott AMA. However, the three baseline scenarios are close together in terms of overall demand; Baseline Scenario Three, the highest demand scenario, is only 15 percent greater than Baseline Scenario One, the lowest demand scenario. The groundwater supply is also fairly consistent between the three scenarios, with Baseline Scenario One utilizing approximately 81 percent groundwater and Baseline Scenario Three utilizing 75 percent groundwater. Because many CAWS were issued prior to the declaration of the Prescott Active Management Area no longer being in a state of safe-yield, groundwater-based growth makes up a large portion of the increase in demand in the municipal sector between 2007 and 2025.   However, increased use of reclaimed water, primarily through underground storage and recovery, is also projected to increase between 2007 and 2025.

The anticipated range in Municipal demand is relatively small as is the range in the potential volume of groundwater used. Consequently, the differences in the baseline scenarios have relatively little impact on the ability of the Prescott AMA to meet its water management goal of safe-yield. As shown in Figure 9-3, groundwater remains a significant source of supply to meet Municipal demand in the Prescott AMA.

Figure 9-3 2025 Projected Municipal Supplies
Prescott Active Management Area



	2025 Scenario One	2025 Scenario Two	2025 Scenario Three
TOTAL	28,651	30,703	32,921
Surface water	1,335	1,335	1,335
Reclaimed water	3,994	5,575	6,853
Exempt Well Groundwater	3,754	4,604	4,936
Municipally Provided Groundwater	19,568	19,189	19,796

9.3.1 Baseline Scenario One Results

In Baseline Scenario One, projected Municipal demand is 51 percent higher in 2025 at 28,651 acre-feet (*See Figure 9-2*) than in 2006 when it was 19,015 acre-feet.

Groundwater demand increases by 38 percent, from 16,912 acre-feet in 2006 to 23,322 acre-feet by 2025 (*See Figure 9-3*).

The proportion of Municipal sector demand increases from 81 percent of total AMA demand in 2006, to 92 percent by 2025 (*See Figure 8-1*).

9.3.2 Baseline Scenario Two Results

Municipal demand in Baseline Scenario Two increases by 62 percent, from 19,015 acre-feet in 2006 to 30,703 acre-feet in 2025 (*See Figure 9-2*).

Groundwater demand in Baseline Scenario Two is about 41 percent greater in 2025 than in 2006, increasing from 16,912 acre-feet to 23,793 acre-feet *(See Figure 9-3)*.

The proportion of Municipal sector demand increases from 81 percent of total AMA demand in 2006, to 90 percent by 2025 (*See Figure 8-1*).

9.3.3 Baseline Scenario Three Results

Municipal demand in Baseline Scenario Three increases by 73 percent from 19,015 acre-feet in 2006 to 32,921 acre-feet in 2025 (*See Figure 9-2*).

Groundwater demand in Baseline Scenario Three is about 46 percent greater in 2025 than in 2006, increasing from 16,912 acre-feet to 24,733 acre-feet *(See Figure 9-3).*

The proportion of Municipal sector demand in Baseline Scenario Three increases from 81 percent of total AMA demand in 2006, to 85 percent by 2025 (*See Figure 8-1*).

10. INDUSTRIAL PROJECTIONS

As discussed in Section 3.1.2, the Industrial sector is made up of a number of different subsectors. When completing the Industrial projections, three projected baseline scenarios were developed for each Industrial subsector in the AMA. This method allowed for individual subsector analysis and resulted in a relatively limited range of potential Industrial demand in the AMA. The Prescott AMA Industrial subsectors are turf-related facilities, sand and gravel, and the generic catch-all category other Industrial. Subsector demand scenarios were added together to derive the AMA's range of the total Industrial demand projections.

10.1 Description of Demand Methodologies and Assumptions

The Prescott AMA Industrial demand projection scenarios (*See Figure 10-1*) were developed using a combination of methods:

- *Trend line* analysis (where the X value is a measure of time) was generally used to predict future water use if an Industrial subsector's historical water use had a strong relationship ($R^2 > 0.6$) to time. Future water use was projected by assuming the past trend would continue through time. Trend line analysis was also used to study the rate of growth or decline in the number of facilities within a subsector over time. This analysis was especially helpful in detecting when established water use trends start to change.

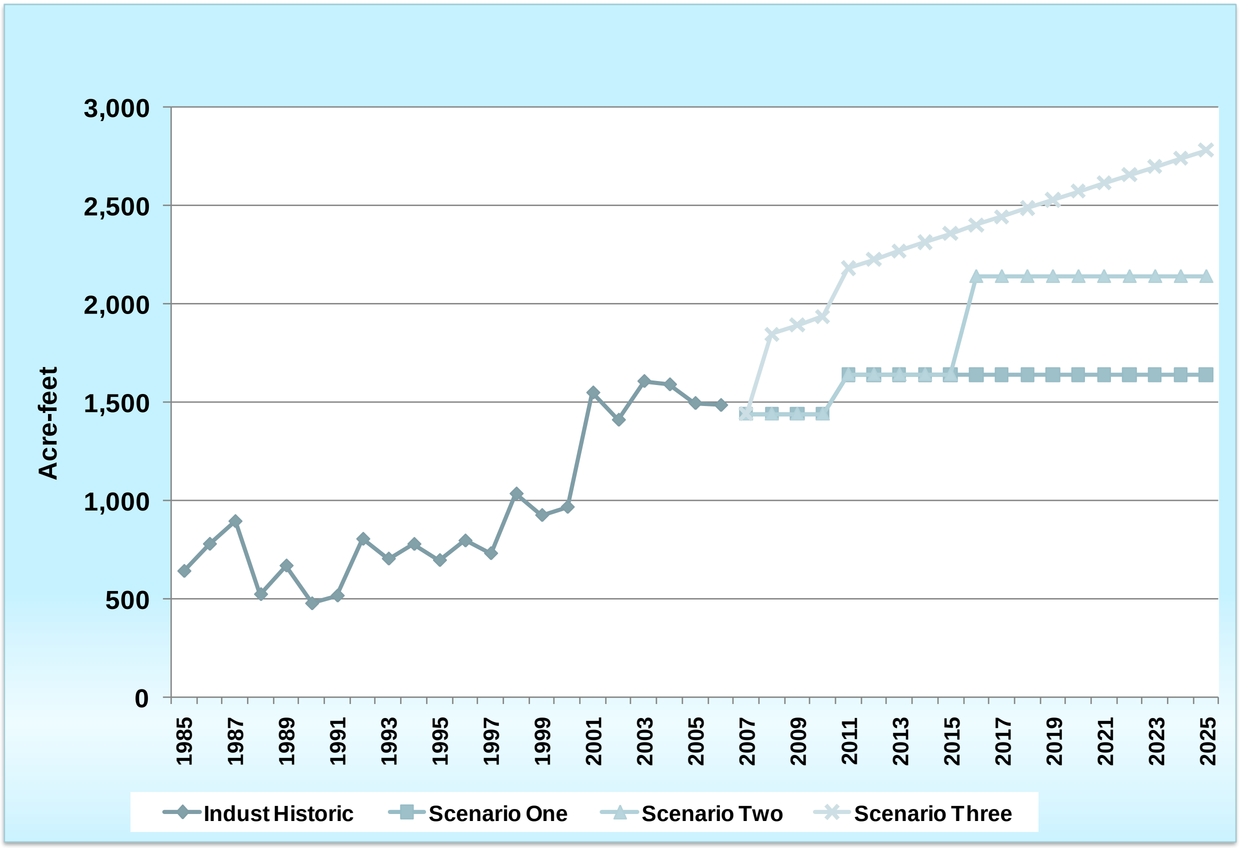
- Generally, if a subsector did not exhibit a strong relationship to time, then one of the following two methods was used: the scenario was developed by AMA staff or sector professional based on professional judgment or the *average historical use* or *current use* was *held constant through time*. See Appendix 5 for more details on the specific methodology used in projecting each Industrial subsector.

As mentioned previously, it is important to note that ADWR defines an Industrial user as an entity that uses water for a non-agricultural purpose and does not receive water from a municipal source. Generally, Industrial users have their own wells and associated water rights or withdrawal permits. The Industrial sector predominately uses groundwater to meet its demand; however, non-groundwater supplies are counted in this sector if they are not supplied by a municipal provider. See Appendix 5 for a more detailed description of individual Industrial subsector assumptions.

Factors Driving Future Industrial Use in Prescott

The factors that commonly drive Industrial growth in a region are population growth and the health of the economy. In the Prescott AMA, all three subsector uses may be affected by these factors, however, it is not anticipated that turf use, especially golf courses served by groundwater rights, will grow proportionally with population. Industrial demand is also limited to some extent by the ownership and availability of grandfathered water rights in an AMA as well as the availability of municipal supplies to serve the facility. As discussed in *Section 5.2.1*, a large portion of the unused water allotment within grandfathered rights that could be utilized for Industrial purposes in the AMA are not anticipated to be used in this period.

Figure 10-1 Historical and Projected Industrial Demand Prescott Active Management Area



10.1.1 Baseline Scenario One Demand Methodology and Assumptions

Baseline Scenario One (*See Table 10-1*) for the Prescott AMA assumed the following occurs:

- Turf water demand held constant at 2006 value; assumes all new turf facilities would be served by municipal providers;
- Sand and gravel water demand increases by 200 acre-feet over 2006 value; assumes use by a newly issued mineral extraction permit;
- Other Industrial use remains constant at its historical average.

10.1.2 Baseline Scenario Two Demand Methodology and Assumptions

Baseline Scenario Two (*See Table 10-1*) for the Prescott AMA assumed the following occurs:

- Turf water demand held constant at 2006 value until 2016 when volume for one additional Industrial golf course is added; assumes all other new turf facilities would be served by municipal providers;
- Sand and gravel water demand increases by 200 acre-feet over 2006 value; assumes use by a newly issued mineral extraction permit;

- Other Industrial use remains constant at its historical average.

10.1.3 Scenario Three Demand Methodology and Assumptions

Baseline Scenario Three (*See Table 10-1*) for the Prescott AMA assumed the following occurs:

- Turf water demand grows at an annual rate from current levels based on historical trend lines from 1985 to 2006;
- Sand and gravel water demand increases by 200 acre-feet over 2006 value; assumes use by a newly issued mineral extraction permit;
- Other Industrial use follows historical trend line based on 1985 to 2006 use.

Table 10-1 2025 Projected Industrial Demand by Facility Type Prescott Active Management Area

Type of Facility	2025 Scenario One	2025 Scenario Two	2025 Scenario Three
Sand and Gravel Operations	335	335	335
Turf-Related Facilities	807	1307	1,689
Other	498	498	760
Total	**1,640**	**2,140**	**2,784**

All volumes are in acre-feet.

10.2 Description of Supply Methodology and Assumptions

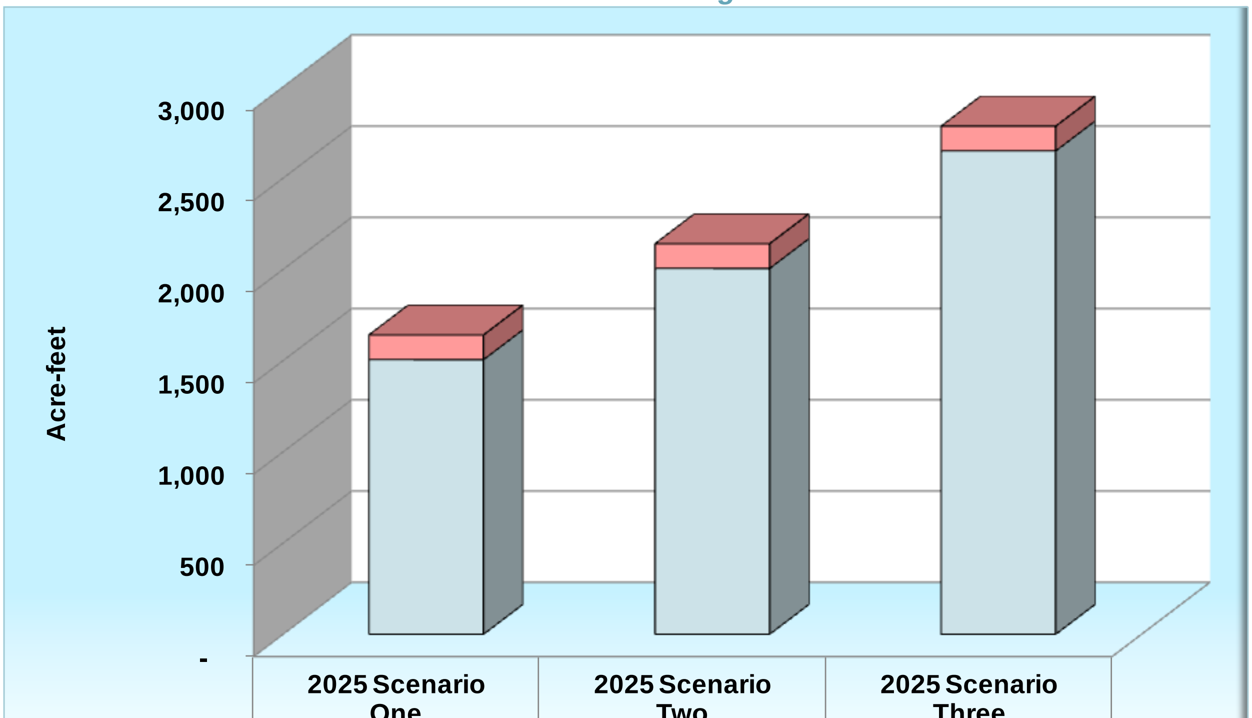
The assumption was made that Industrial demand would be served by the same supplies in the same proportions as in 2006 (*See Figure 10-2*), with exceptions based upon specific information available to ADWR. This supply methodology was similar to the one used in the 3MP when supply proportions from 1995 were projected forward.

In 2006, the Prescott Industrial demand was met by approximately 92 percent groundwater and 8 percent surface water.

10.3 Overview of Industrial Results

Historically, Industrial demand in the Prescott AMA has been limited; however, from 1985 to 2006 it grew by 75 percent resulting in total Industrial use of 1,486 acre-feet. The growth during this time period was primarily due to an increase in turf related demand and Other Industrial use starting in 2000. Use of water by the sand and gravel subsector has stayed relatively constant over time. Baseline Scenarios One through Three illustrate a reasonable range of Industrial water use. It is unlikely that demand will exactly follow any one of the baseline scenarios from 2007 until 2025, but it is reasonable to assume that demand will fluctuate within this range of demand scenarios (*See Table 10-1*).

Figure 10-2 2025 Projected Industrial Supplies
Prescott Active Management



	2025 Scenario One	2025 Scenario Two	2025 Scenario Three
TOTAL	1,640	2,140	2,784
Surface Water	135	135	135
Groundwater	1,505	2,005	2,649

10.3.1 Baseline Scenario One Results

In Baseline Scenario One, Industrial demand increases approximately 10 percent from 1,486 acre-feet in 2006 to 1,640 acre-feet in 2025 (*See Figure 10-1*).

By 2025, approximately 92 percent of the demand is met with groundwater and 8 percent is met with surface water (*See Figure 10-2*).

10.3.2 Baseline Scenario Two Results

In Baseline Scenario Two, Industrial demand increases about 44 percent from 1,486 acre-feet in 2006 to 2,140 acre-feet 2025 (*See Figure 10-1)*.

By 2025, approximately 94 percent of the demand is met with groundwater and approximately 6% of the demand is met with surface water.

10.3.3 Baseline Scenario Three Results

In Baseline Scenario Three, Industrial demand increases over 87% from 1,486 acre-feet in 2006 to 2,784 acre-feet in 2025 (*See Figure 10-1*).

By 2025, approximately 95% of the demand is met with groundwater and approximately 5% of the demand is met with surface water.

11. AGRICULTURAL PROJECTIONS

11.1 Description of Demand Methodology and Factors Driving Agricultural Water Use

Total Agricultural demand is the sum of the IGFR demands. These demands were categorized into non-exempt IGFR, exempt IGFR, and Exception User demands. In the Prescott AMA, Exception Users are those users in CVID that do not have an IGFR but were served surface water by CVID; those users are now served recovered reclaimed water by CVID (See Section 5.3).

Three baseline demand scenarios each were developed for non-exempt IGFR, exempt IGFRs, and Exception users. The overall Agricultural demand scenarios were then calculated by adding together the individual demand scenarios. This method allowed for the greatest range of potential demand.

In general, projecting agricultural demand in the Prescott AMA was difficult due to the unique pattern of development that exists in the AMA, specific rules regarding extinguishment of IGFRs, and the unique nature of CVID's water use. The Prescott AMA individual Agricultural demand projections (*See Figure 11-1*) were developed using a combination of the following methods:

- *Trend line analysis* of historical water use (where the x-value is a measure of time)
- *Projections by AMA staff or sector professionals*
- *Average historical use* (plus or minus one standard deviation for some baseline scenarios)

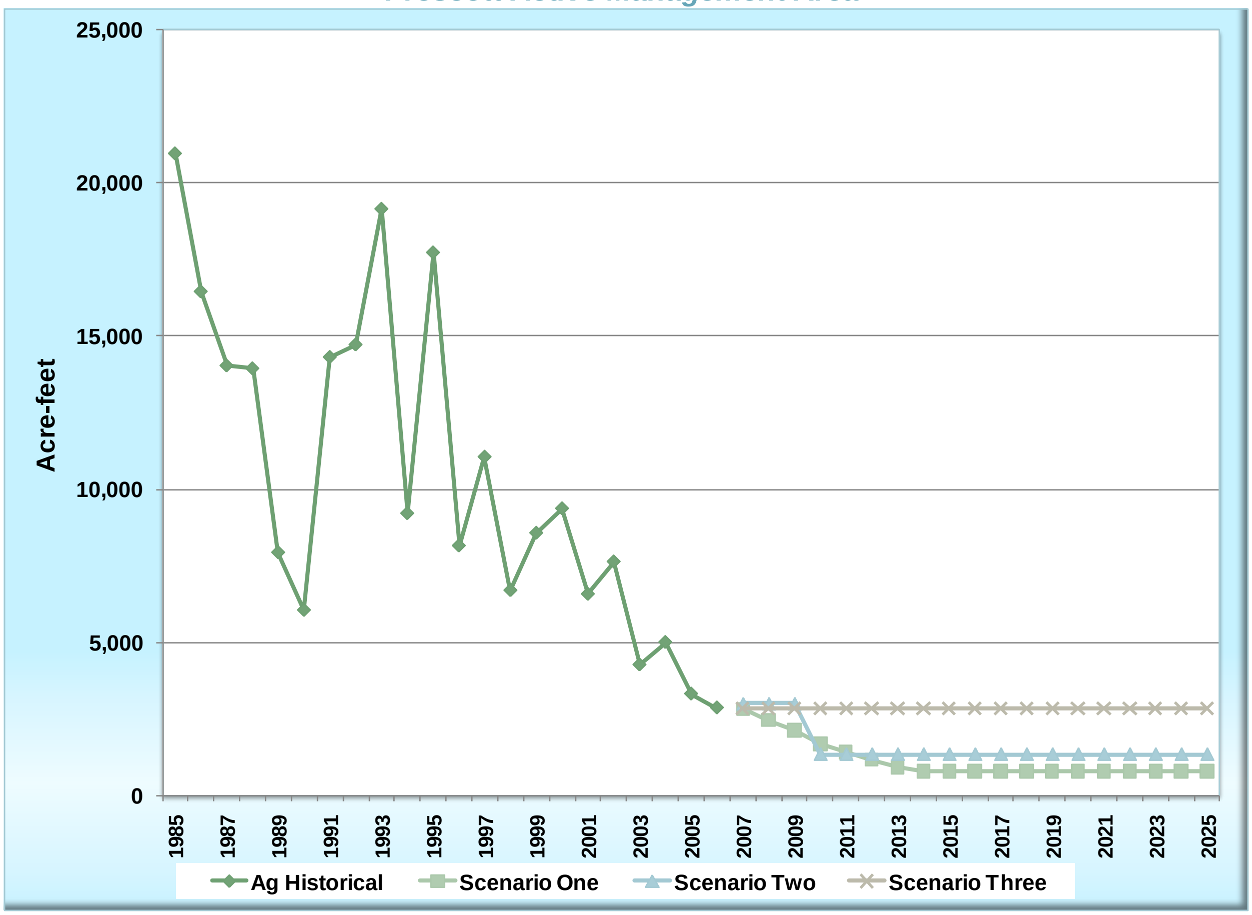
Over the past 20 years, acreage and groundwater allotments have decreased while Agricultural demand has fluctuated. There is no apparent correlation between changes in Agricultural demand and the decrease in acreage and groundwater allotments (See Section 5.3). Compared to maximum groundwater allotments, total Agricultural demand is typically around 50 percent of the allotments, but can fluctuate significantly with market conditions and climate. Because the flexibility account provisions permit farmers to bank the unused portion of the groundwater allotment for future use, the groundwater allotment itself does not necessarily limit demand.

11.1.1 Baseline Scenario One Demand Methodology and Assumptions

Baseline Scenario One (*See Table 11-1*) for the Prescott AMA includes the following assumptions:

- Demand by non-exempt IGFRs would decline based on recent trends;
- Demand by exempt IGFRs would continue below the recent historical average water use;
- Demand by Exception Users would continue.

Figure 11-1 Historic and Projected Agricultural Demand
Prescott Active Management Area



11.1.2 Baseline Scenario Two Demand Methodology and Assumptions

Baseline Scenario Two (*See Table 11-1*) for the Prescott AMA includes the following assumptions:

- Extinguishments of non-exempt IGFRs would occur;
- Demand by exempt IGFRs would continue below the recent historical average water use;
- Demand by Exception Users would continue.

11.1.3 Baseline Scenario Three Demand Methodology and Assumptions

Baseline Scenario Three (*See Table 11-1*) for the Prescott AMA assumed that all demands would be held constant at 2006 levels.

Table 11-1 2025 Projected Agricultural Demand
Prescott Active Management Area

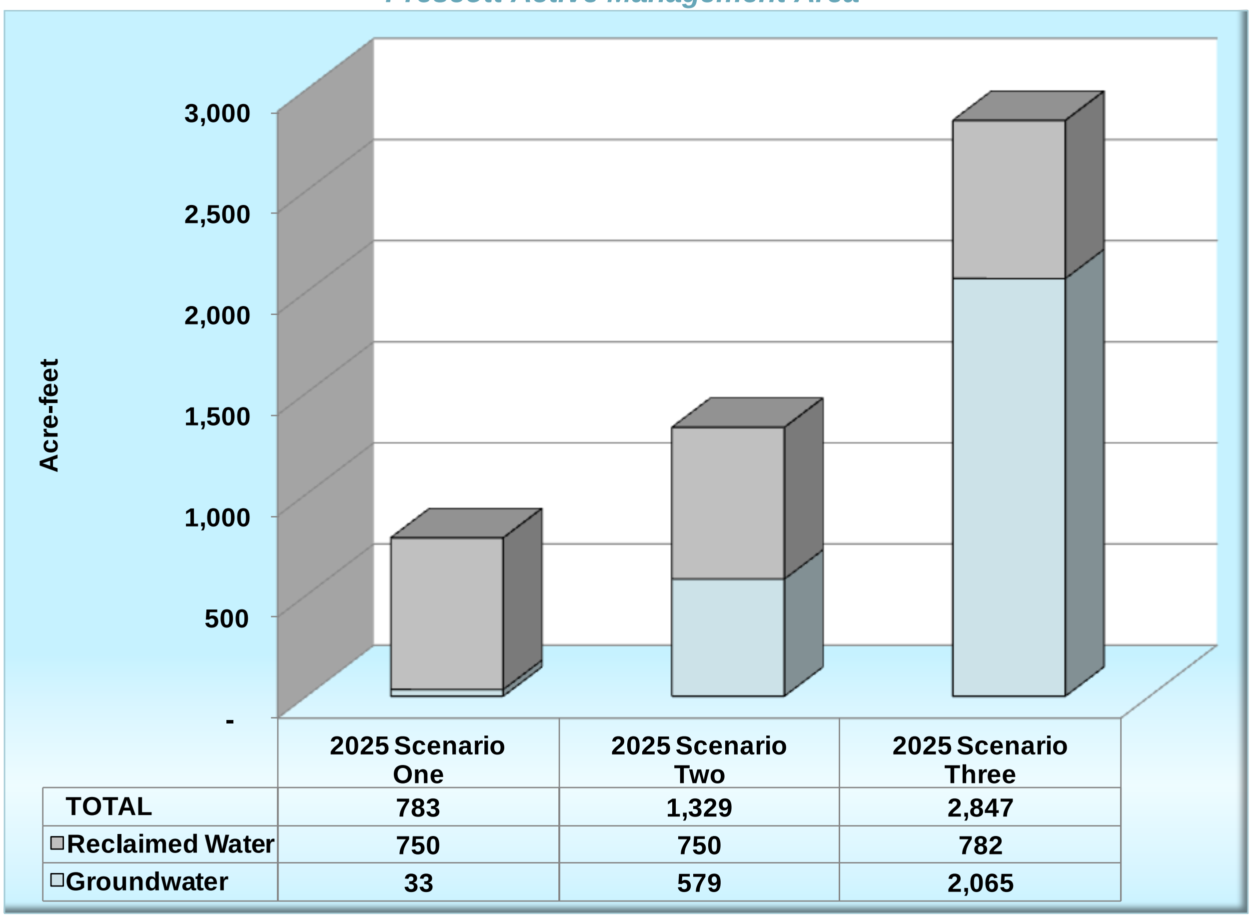
Baseline Scenario	Total Water Use	Groundwater Use
One	783	33
Two	1,329	579
Three	2,847	2,065

All volumes are in acre-feet.

11.2 Agricultural Supply Methodology and Assumptions

Supplies were generally assumed to be groundwater to meet IGFR demands, and recovered reclaimed water to meet Exception User demands (*See Figure 11-2*).

Figure 11-2 2025 Projected Agricultural Supplies
Prescott Active Management Area



11.3 Overview of Agricultural Results

Historically, total agricultural water demand in the Prescott AMA has fluctuated around a decreasing trend (See Section 5.3). Future agricultural demand in the AMA will most likely depend on extinguishment of IGFR's for Assured Water Supply purposes, precipitation in the

AMA, and the pattern of urbanization. Projection scenario results indicate that demand in 2025 could range from approximately 783 acre-feet to approximately 2,847 acre-feet (*See Table 11-1*).

11.3.1 Baseline Scenario One Results

In Baseline Scenario One, Agricultural demand decreases by almost 73 percent, from 2,847 acre-feet in 2006 to 783 acre-feet by 2014; this level is maintained through 2025 (*See Figure 11-1*). The demands in 2025 are projected to be met with approximately 96 percent recovered reclaimed water and 4 percent groundwater (*See Figure 11-2*).

11.3.2 Baseline Scenario Two Results

In Baseline Scenario Two, Agricultural demand decreases by 53 percent, from 2,847 acre-feet in 2006 to 1,329 acre-feet in 2010; this level is maintained through 2025 (*See Figure 11-1*). The demands in 2025 are projected to be met with 56 percent recovered reclaimed water and 44 percent groundwater.

11.3.3 Baseline Scenario Three Results

In Baseline Scenario Three, Agricultural demand is projected to remain the same as 2006 demand, which was 2,847 acre-feet per year (*See Figure 11-1*). The source of supply is also maintained at 2006 levels, or approximately 27 percent recovered reclaimed water and 73 percent groundwater.

12. RECHARGE PROJECTIONS

12.1 Projection Methodology of Surface Water Recharge at USFs

Surface water recharge at Constructed USFs and annual recovery is done only by the City of Prescott. Although the volume of surface water available for storage will fluctuate based on supply, it is projected to continue through 2025. The projection of the volume that would be stored by the City of Prescott was based on the average historical volume of surface water stored and the current capacity of permitted recharge facilities.

12.2 Projection Methodology of Reclaimed Water Recharge at USFs

Reclaimed water storage at Constructed USFs is the primary type of recharge occurring in the Prescott AMA. This is anticipated to continue through at least 2025. Projecting reclaimed water storage began with a projection of the volume of reclaimed water supply in the AMA. The available reclaimed water supply was projected using a “reclaimed water GPCD.” The reclaimed water GPCD was calculated by dividing historical reclaimed water generated by historical population. In the Prescott AMA, this averaged 64 GPCD. The reclaimed water GPCD was then multiplied by the projected large provider population to project future reclaimed water generated.

The projected uses of reclaimed water by all water use sectors were subtracted from the amount projected to be generated. In the Municipal sector, reclaimed water use was projected based on individual assumptions for each large provider. Assumptions were based on information included in the City of Prescott’s DAWS, the City of Prescott’s agreement with CVID, the Town of Prescott Valley’s historical use of reclaimed water, current and future wastewater treatment capacity, and a review of current ability to store and recover reclaimed water.

The volume of reclaimed water available for storage varied each year based on the differences between the projected population among the three baseline scenarios. For example, the higher demands in the Baseline Scenarios actually result in increases in reclaimed water production.

12.3 Overview of Recharge Results

12.3.1 Baseline Scenario One Results

The projected volume of surface water stored in the year 2025 is 1,335 acre-feet. This is an increase of over 480 percent from the 229 acre-feet stored in 2006 (*See Table 12-1*). Reclaimed water storage is projected to be 7,780 acre-feet in the year 2025. This is an increase of almost 115 percent, or 4,159 acre-feet over the volume stored in 2006.

From 2007 through 2025, cumulative storage of surface water is approximately 6,316 acre-feet in Baseline Scenario One. When added to the 5,217 acre-feet that had been stored and recovered from 1985 through 2006, the result is a total volume of surface water annually stored and recovered in the Prescott AMA through 2025 of approximately 11,533 acre-feet.

In Baseline Scenario One, the projected cumulative total volume of reclaimed water stored from 2007 through 2025 is 117,383 acre-feet. Thus, by 2025, the total volume of reclaimed water stored in Baseline Scenario One, including the volume of reclaimed water that had been stored through 2006, is 149,693 acre-feet. These figures reflect the volume of water stored, not including cuts to the aquifer or physical losses (*See Table 12-2*).

Table 12-1 2006 Historical and 2025 Projected Water Artificial Recharge Prescott Active Management Area

Recharge Facility	2006	Scenario One	Scenario Two	Scenario Three
Underground Storage Facilities (Constructed)				
Number of Facilities	3			
Surface Water Stored	229	1,335	1,335	868
Reclaimed Stored	3,621	7,780	7,780	8,489
Total Stored	**3,850**	**9,115**	**9,115**	**9,357**

Note: All volumes are in acre-feet, and include water delivered to be stored, minus physical losses.

Table 12-2 2006 and Projected Cumulative Artificial Recharge Credits Through 2025 Prescott Active Management Area

Long Term Storage Credits	2006	2025 Scenario One	2025 Scenario Two	2025 Scenario Three
Underground Storage Facilities				
Reclaimed water	32,310	149,693	158,788	164,401
Surface water	5,218	11,533	30,446	30,850
TOTAL	37,528	161,227	189,234	195,251
Extinguishment Credits				
Generated	134,495			
Recovery	16,042	31,523	59,172	70,043
Credits Remaining in Storage	**21,485**	**129,703**	**130,062**	**125,208**

Note: Stored water is water delivered to be stored, minus losses and the cut to the aquifer if applicable. All volumes are in acre-feet.

12.3.2 Baseline Scenario Two Results

The projected volume of surface water stored in the year 2025 is 1,335 acre-feet. This is an increase of over 480 percent from the 229 acre-feet stored in 2006 (*See Table 12-1*). Reclaimed water storage is projected to be 7,780 acre-feet in the year 2025. This is an increase of almost 115 percent, or 4,159 acre-feet over the volume stored in 2006.

From 2007 through 2025, cumulative storage of surface water is approximately 25,228 acre-feet in Baseline Scenario Two. When added to the 5,218 acre-feet that had been stored and recovered from 1985 through 2006, the result is a total volume of surface water annually stored and recovered in the Prescott AMA through 2025 of approximately 30,446 acre-feet.

In Baseline Scenario Two, the projected cumulative total volume of reclaimed water stored from 2007 through 2025 is 126,478 acre-feet. Thus, by 2025, the total volume of reclaimed water stored in Baseline Scenario Two, including the volume of reclaimed water that had been stored through 2006, is 158,788 acre-feet. These figures reflect the volume of water stored, not including cuts to the aquifer or physical losses (*See Table 12-2*).

12.3.3 Baseline Scenario Three Results

The projected volume of surface water stored in the year 2025 is 868 acre-feet. This is an increase of over 275 percent from the 229 acre-feet stored in 2006 (*See Table 12-1*). Reclaimed water storage is projected to be 8,489 acre-feet in the year 2025. This is an increase of almost 135 percent, or 4,868 acre-feet over the volume stored in 2006.

From 2007 through 2025, cumulative storage of surface water is approximately 25,632 acre-feet in Baseline Scenario Three. When added to the 5,218 acre-feet that had been stored and recovered from 1985 through 2006, the result is a total volume of surface water annually stored and recovered in the Prescott AMA through 2025 of 30,850 acre-feet.

In Baseline Scenario Three, the projected cumulative total volume of reclaimed water stored from 2007 through 2025 is 132,091 acre-feet. Thus, by 2025, the total volume of reclaimed water stored in Baseline Scenario Three, including the volume of reclaimed water that had been stored through 2006, is 164,401 acre-feet. These figures reflect the volume of water stored, not including cuts to the aquifer or physical losses (*See* Table 12-2).

13. ADDITIONAL SCENARIOS

13.1 Absence of Stream Channel Recharge Projected Scenario

This Assessment includes three baseline scenarios incorporating reduced surface water supplies in recognition of potential climate change impacts that would result in decreased volumes of natural stream channel recharge along Granite and Lynx Creek and in Mint Wash. The consensus of an international panel of climate science experts, the International Panel on Climate Change (Intergovernmental Panel on Climate Change, 2007), is that the southwestern United States is likely to experience significant impacts from warming, particularly in the water resources sector. IPCC predicts with high confidence that average temperatures will continue to increase. There is now also a strong indication of reductions in winter precipitation in northern Mexico and the southern portions of the Southwestern United States.

This means that even if total precipitation increases on average across the globe, drought is likely to become an even greater problem in this region than it is today, perhaps becoming the new “normal” (Seagar & Ting, 2007). The IPCC findings also conclude that the intensity of precipitation is likely to increase in future climate scenarios for the southwestern United States. Therefore, both extremes of precipitation – floods and droughts – will increasingly challenge water managers in the region. Increases in temperature, particularly in summer, will affect demand for water in Arizona. Higher temperatures lead to more demand for electricity for air conditioning; more water required to support agriculture, landscaping, and ecosystems; and more evaporative losses from reservoirs, etc.

Within Arizona, loss of snowpack along the Mogollon Rim and other high elevation areas will likely change the volume and timing of peak runoff and may impact downstream users and habitat (Jacobs, 2009). Several climate change models exist for the southwestern region of the United States, but at this time, are not localized enough to be useful for the purposes of this Assessment.

13.1.1 Absence of Stream Channel Recharge Projection Methodology

In addition to Baseline Scenario One, Two, and Three, an additional three projection scenarios were prepared that included projecting an absence of stream channel recharge along Granite and Lynx Creek and in Mint Wash during drought periods. In each of the three projection scenarios, the impact of eliminating stream channel recharge is that the net natural recharge volume decreases by 2,300 acre-feet each year. This decrease is consistent in each of the three scenarios.

The ADWR Water Management Division selected a representative drought period from 2012 to 2019 for the Prescott AMA to be consistent with the period selected in the other AMAs based on Colorado River modeling. As previously stated, during this period it was assumed that only mountain front recharge occurs as an input to the system; there is no component included for stream channel recharge.

13.1.2 Absence of Stream Channel Recharge Projection Results

In this projection, the absence of stream channel recharge directly impacts net natural recharge; it does not impact a renewable supply that is available for use. As discussed in Section 8.1.3, net natural recharge is estimated to be a constant value in the projections. Consequently, the result of this projection is a decrease in the volume of net natural recharge in each Baseline Scenario yielding a cumulative total of 18,400 acre-feet for the drought period.

Figure 13-1 Shortage Scenario One Projected Annual Overdraft
Prescott Active Management Area

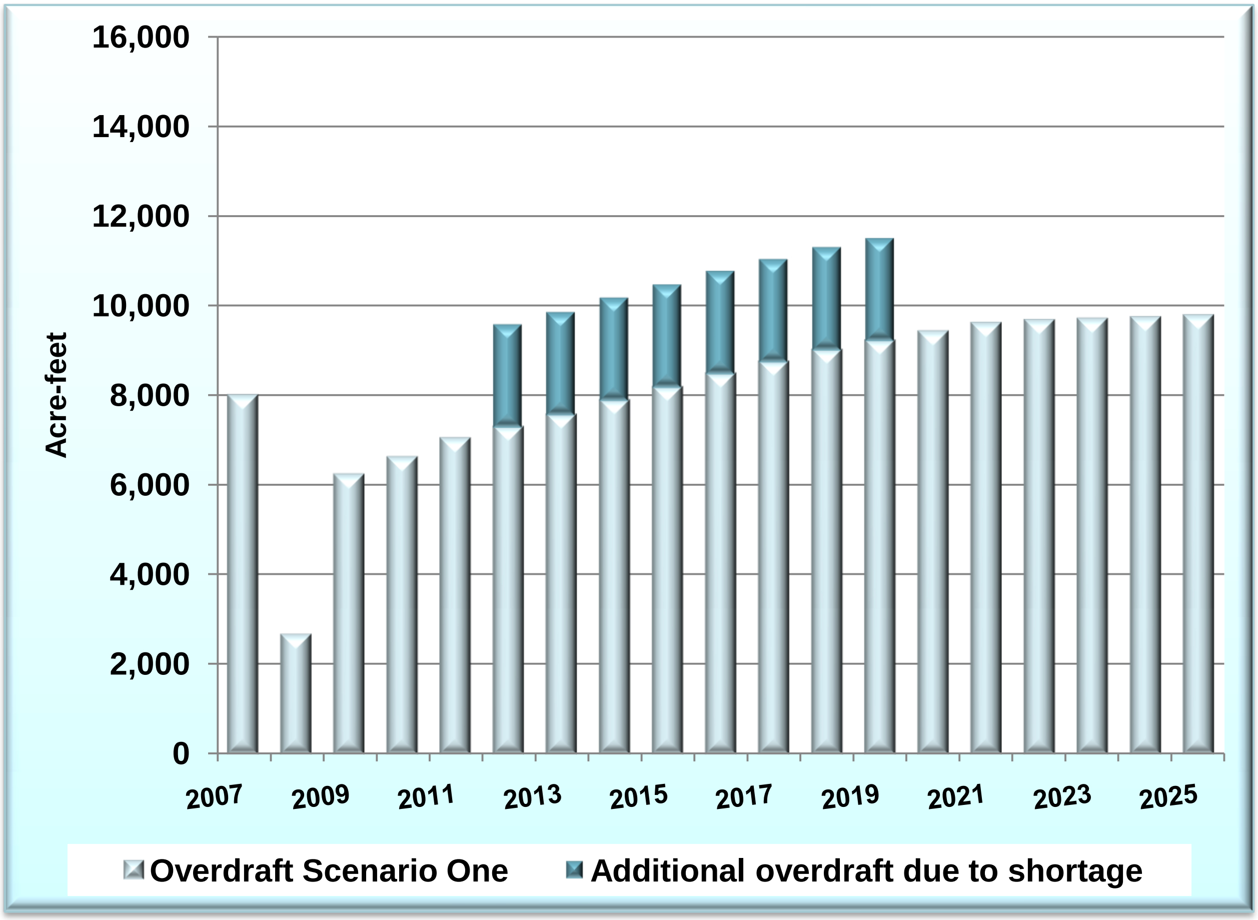


Figure 13-2 Shortage Scenario Two Projected Annual Overdraft Prescott Active Management Area

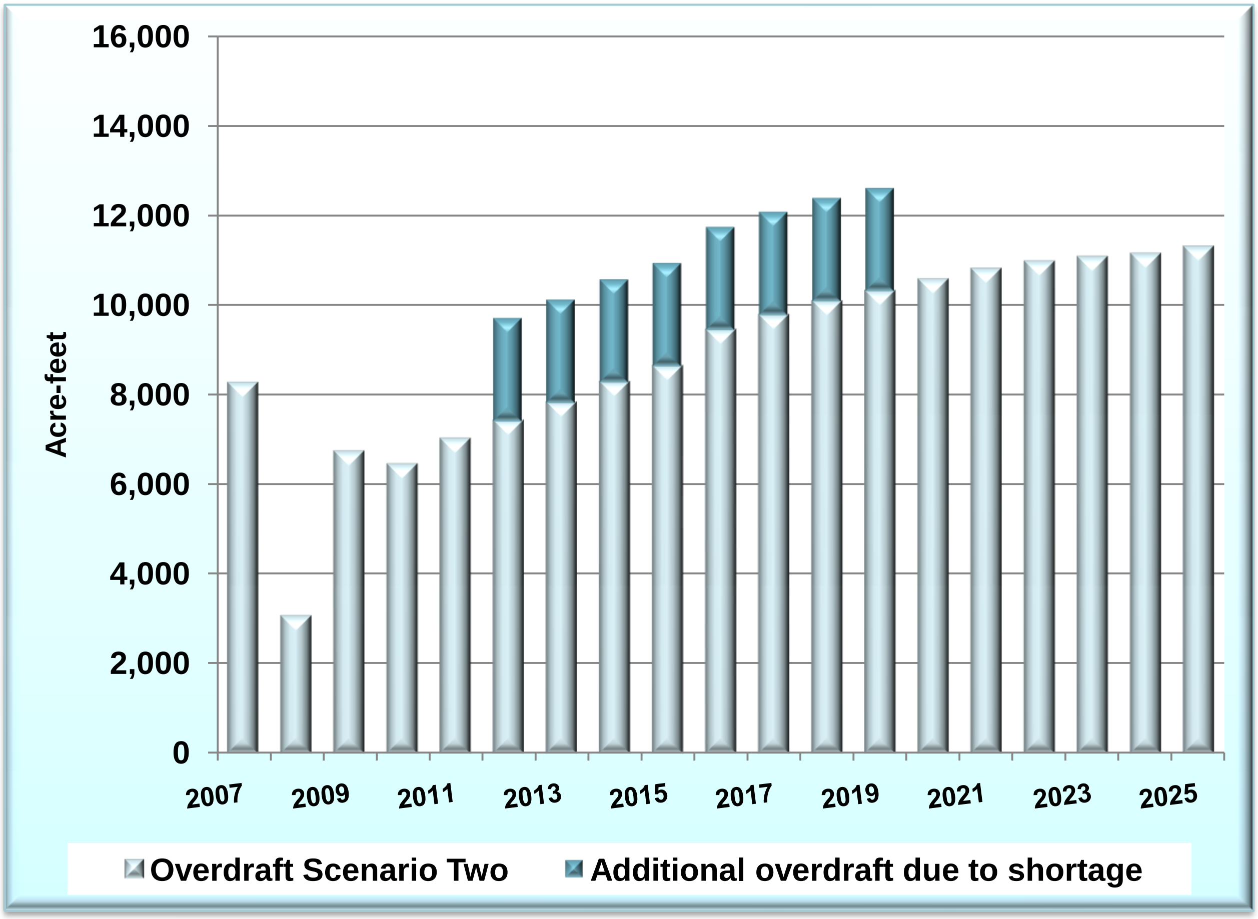
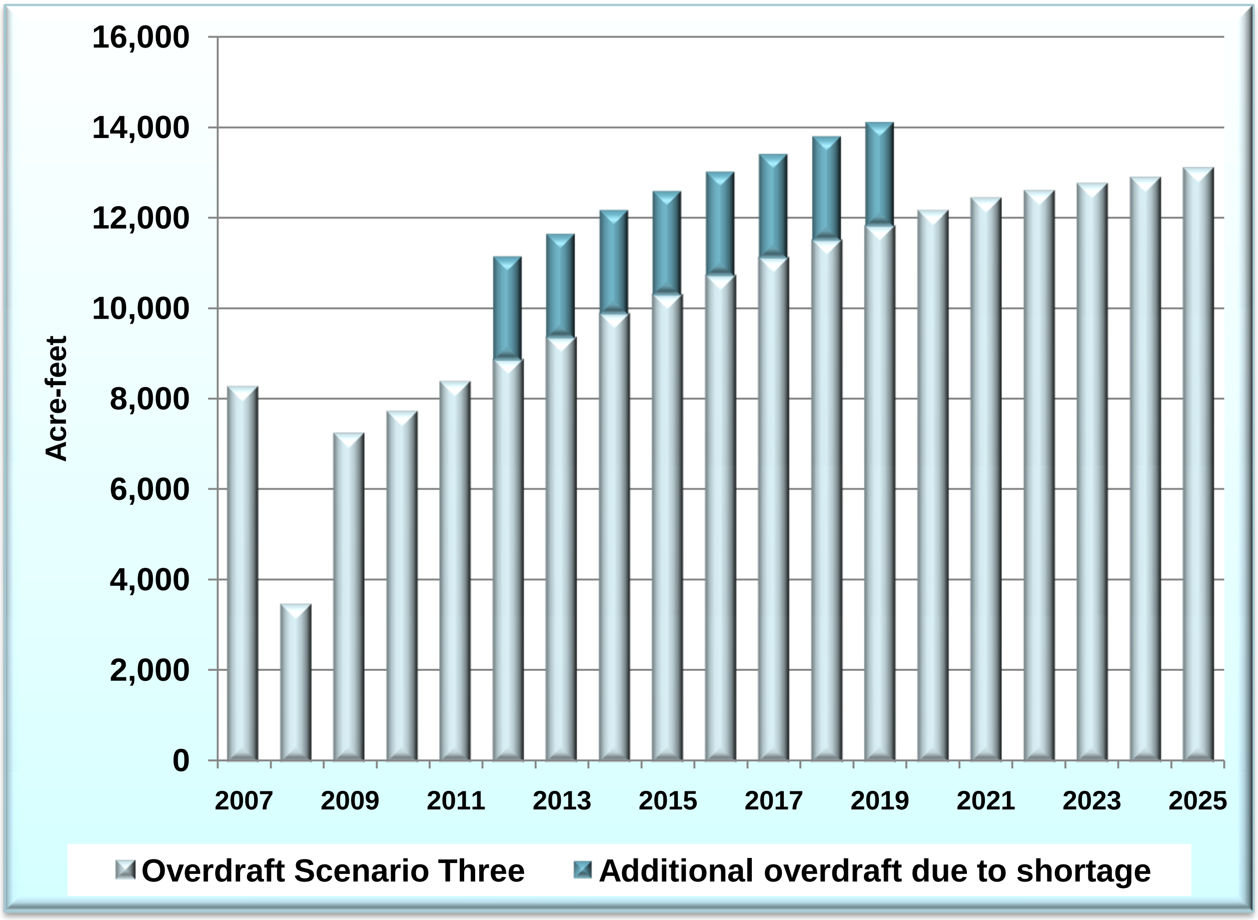


Figure 13-3 Shortage Scenario Three Projected Annual Overdraft Prescott Active Management Area



13.1.3 Implications

The absence of stream channel recharge does not directly impact supply. Instead, it decreases the net natural recharge within the AMA and directly impacts overdraft. In each year of the drought period, overdraft is increased by 2,300 acre-feet annually, further exacerbating the overdraft condition within the AMA and potentially impacting aquifer storage. Recent provisional modeling has indicated that the Prescott AMA aquifers may be more dependent on significant flood recharge events than previously thought. Therefore, with all other factors treated equal, the primary impact of drought in the Prescott AMA is reduced groundwater-in-storage due mainly to the omission of flood recharge (Nelson K. , ADWR Hydrologist, 2010).

13.2 Use of Groundwater Transported from the Big Chino Sub-basin Scenario

In addition to Baseline Scenarios One, Two, Three and the three Absence of Stream Channel Recharge Scenarios, a Use of Groundwater Transported from the Big Chino Sub-basin Scenario was developed for the Prescott AMA. Municipal water users in the AMA have actively been working towards transportation and use of groundwater from the Big Chino Sub-basin and the City of Prescott has this source of supply included within its most recently modified DAWS. Therefore, it is reasonable to assume that there will be some volume of groundwater transported from the Big Chino Sub-basin utilized in the Prescott AMA within the projected period. Developing access to groundwater from the Big Chino Sub-basin was accomplished by the City of Prescott and the Yavapai Prescott Indian Tribe relinquishing their Central Arizona Project allotments.

Additionally, it is generally accepted within the AMA that it will be difficult, if not impossible, to achieve safe-yield in the Prescott AMA by 2025 without the utilization of alternative water supplies. The baseline scenarios in this Assessment illustrate this fact as no scenario results in a safe-yield condition within the projected period. This scenario was developed to analyze whether the goal of safe-yield by 2025 could be achieved through utilization of groundwater transported from the Big Chino Sub-basin.

In the Use of Groundwater Transported from the Big Chino Sub-basin Scenario, new assumptions were applied to Baseline Scenario One, which was chosen since it was the scenario closest to meeting safe-yield. Similar to the shortage scenarios, demand was not altered from Baseline Scenario One. The only changes in the template assumptions were an addition of transported groundwater used annually.

13.2.1 Background

In 2004, the City of Prescott (City) entered into an intergovernmental agreement with the Town of Prescott Valley and in partnership with them, purchased the Big Chino Water Ranch (BCWR). The BCWR is comprised of over 6,500 acres of deeded and state trust lands located about 30 miles from the City's main well field located in the Town of Chino Valley. Since the purchase of the BCWR, the City and the Town of Prescott Valley have initiated hydrologic investigation of the BCWR, drilled monitoring wells, completed a groundwater model and conducted pipeline design analysis, among other activities.

In 2007, the City submitted an application for Modified DAWS that included groundwater transported from the Big Chino Sub-basin. The City and Town of Prescott Valley have indicated that they will transport groundwater into the AMA pursuant to the provisions of A.R.S. § 45-555(E) and the volume of water included in the 2007 application for Modified DAWS supported that volume of use. Under the existing proposal, the pipeline is sized to transport up to 12,400 acre-feet. This capacity is derived from peak flow requirements for summertime demand and does not necessarily represent annual capacity. Although there is currently legal action in Superior Court, the Director's decision and order for the application for Modified DAWS recognized that the volume of water that the City may transport under A.R.S. § 45-555(E) is 8,067 acre-feet. The Prescott City Council passed a resolution requiring the groundwater associated with historically irrigated acres (HIA) to be dedicated either toward reaching safe-yield or for mitigation purposes.

The Town of Chino Valley has approached the transportation of groundwater from the Big Chino Sub-basin in a somewhat different manner. The Town of Chino Valley has been purchasing lands in the Paulden area that have been determined to meet the requirements for historically irrigated acres (HIA). In 2007, the Town of Chino Valley received written determinations from ADWR regarding determination of HIA acres and transportation of Big-Chino groundwater. These two determinations recognized over 960 acres of HIA with a transportation allotment of just under 2,900 acre-feet. The Town of Chino Valley has been negotiating mitigation plans with entities concerned over the potential impacts of groundwater pumping and transportation on the Verde River.

Recent developments in the Prescott AMA with respect to an agreement in principle between the City, the Town of Prescott Valley and Salt River Project (SRP) are reflected in this scenario. Specifically, the agreement states that the SRP will not object to the transportation of water associated with HIA acres. Consequently, an estimated volume of transported groundwater associated with HIA acres for use by the City of Prescott and the Town of Prescott Valley was included within the scenario.

13.2.2 Methodology and Assumptions

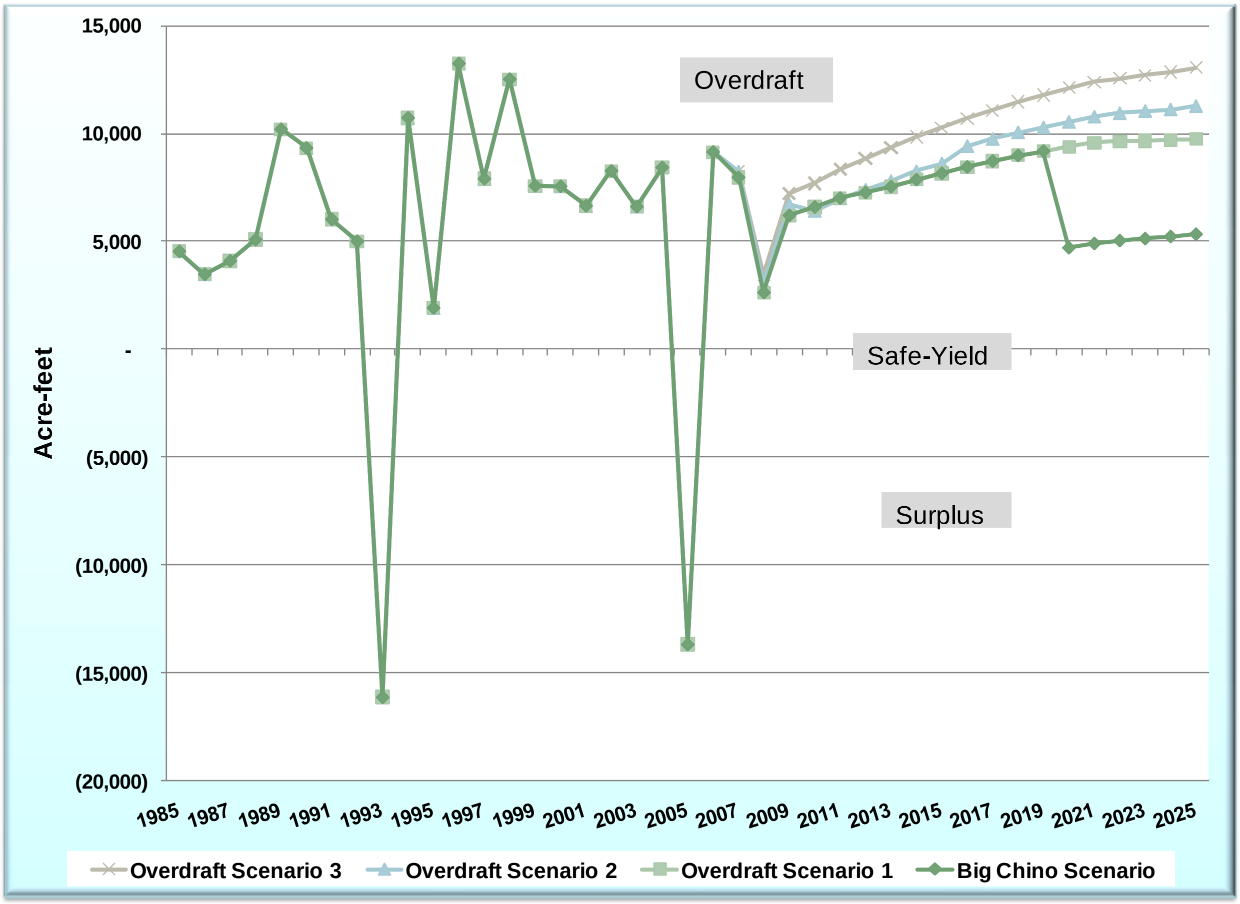
In the Groundwater Transported from the Big Chino Sub-basin scenario, it was assumed that the groundwater would first be utilized by the City of Prescott and the Town of Prescott Valley beginning in 2020. This assumption was based on information supplied by the City of Prescott in their most recent DAWS application. The volume of Big Chino groundwater included in this scenario was 8,067 acre-feet (A.R.S. 45-555(E)) and 3483.78 acre-feet associated with HIA. The cumulative 11,551 acre-feet was included in every year from 2020 through 2025 and was given the highest priority of use.

General assumptions were employed to project the volume of groundwater transported from the Big Chino Sub-basin that would be utilized by the Town of Chino Valley. Currently, the Town of Chino Valley is not a large provider; therefore, the population served by the municipality must be estimated. Additionally, there are a number of small providers that serve water within the town boundaries and there is a significant proportion of exempt domestic wells that provide water to individuals within the town. Consequently, a population that could be served by the Town of Chino Valley and an average GPCD for the provider were estimated to develop potential demand for transported groundwater. The transported groundwater needed to meet this projected demand was included beginning in 2020 and was given the highest priority of use.

13.2.3 Groundwater Transported from the Big Chino Sub-basin Scenario Results

Groundwater transported into the Prescott AMA from the Big Chino Sub-basin, if fully utilized on an annual basis, could significantly help the AMA's efforts to reach safe-yield by 2025. The results of the Groundwater Transported from the Big Chino Sub-basin Scenario indicated that by increasing this use in the municipal sector, the Prescott AMA could come very close to achieving safe-yield by 2025, assuming Baseline Scenario One demands. *Figure 13-4* illustrates the impact of utilization of water from the Big Chino Sub-basin.

Figure 13-4 Groundwater Transportation and other Scenario Comparison Prescott Active Management Area



PART IV THE FOURTH MANAGEMENT PLAN PROCESS

The Code requires ADWR to develop Management Plans for each AMA to assist the AMA in achieving its management goal. The Management Plans contain conservation requirements for the Municipal, Industrial and Agricultural sectors; however, they do not apply to the Indian water use sector. While the Management Plans provide requirements for reductions in water use – it is not the only tool available to ADWR for achieving the management goals and should not be viewed as such.

ADWR has developed Management Plans for each of the previous management periods using similar yet increasingly more complicated approaches. The 1MP (1984-1990) was the first comprehensive attempt to manage groundwater within the AMAs. Development of the mandatory conservation requirements used a very straightforward approach, based on water supply and demand quantification.

The 2MP (1990-2000) employed a more advanced supply and demand analysis incorporating current and future conditions. In the development of conservation requirements ADWR put more emphasis on aggressive and cutting-edge conservation practices for the three main water use sectors. Water supply augmentation was also integrated into the water management strategies in addition to a newly created Conservation and Augmentation Assistance grants program.

The 3MP (2000-2010) was the mid-point of the 45-year timeframe from the inception of the Code in 1980 to the year 2025 by which safe-yield was to be attained. The 3MP recognized the impacts of the other water management programs not addressed through the Management Plans, including the AWS Rules; the Underground Storage and Recovery Program; the CAGRD; and the AWBA. Because of the recognition of these additional management programs, supply and demand analysis vastly improved. However, the conservation requirements included in the 3MP were strikingly similar to the 2MP.

The 3MPs for the AMAs, as well as the findings of the subsequently formed local AMA “Safe-Yield Task Force” (or other similarly named stakeholder groups) and the Governor’s Water Management Commission in 2001, made a series of observations that should frame the development of future water management strategies. Although these observations recognized certain differences among the AMAs, there were fundamental similarities. The principle observations were:

1) While significant progress has been made since the enactment of the Code, it is unlikely that the statutory goals of the AMAs will be met, given the current authorities granted to ADWR;

2) While it is projected that most AMAs will continue to make progress toward achievement of their goals as currently unused renewable water supplies become utilized, we may begin to move in the opposite direction if increased demands outstrip the availability of renewable supplies;

3) Localized areas within AMAs are, and will continue to, experience water management problems disproportionate to those of the AMA as a whole due to infrastructure and renewable water supply access, continued allowable groundwater pumping by grandfathered uses, and recovery of long-term storage credits outside the areas of impact of the recharge facilities.

These observation are a mixture of “good news/bad news”. It is good news from the standpoint that the existing programs and authorities have served this State, most specifically the AMAs, well. We should all be proud of the work accomplished and the progress made to date. The bad news is that with the current authorities, it will be almost impossible to meet the management goals, and may over time move us farther away. These goals are the fundamental underpinnings to ensuring a long-term sustainable water supply for the State of Arizona. The 4MP must emphasize ensuring sustainable water supplies and the effective and efficient management of the State’s most precious resource for Arizona to thrive.

So, what should the 4MP look like? The Management Plans to date have served us well; however, they are not really planning tools that provide succinct options for future water management decisions. They are excellent tools in identifying current and projected water use, mandatory conservation requirements, and potential directions and initiatives that could be pursued to move toward goal achievement and wise, long-term water management. The Management Plans should provide more concise direction regarding what is needed to get to the ultimate goal.

ADWR will approach the 4MP more as a Plan for success than a document that simply identifies the statutory requirements for the main water using sectors. In this Plan, ADWR, in cooperation with the public, will build on past successes but recognize additional observations should be considered, including:

1) Conservation will only get us so far. We will continue to address meaningful conservation requirements, but will also review the "incentives" for utilization of renewable water supplies, reduce the complexity and the administrative workload necessary to implement these programs, and be diligent in their enforcement.
2) Have serious discussions regarding the AMA goals and the implications to the State of not reaching them.
3) Consider different approaches to water management among the AMAs, recognizing local conditions and community values.
4) Address the limitations of the Management Plans and underlying authorities as we determine what course of action to follow.
5) Recognize sub-area issues and consider alternative management strategies to address areas where conditions are positive and conditions are negative.
6) Develop, in cooperation with local water users and other water resource entities, a long-term water management strategy to get the AMAs where we need them to be by identifying what specific actions/steps we need to take and what resources will be required to accomplish this strategy.

BIBLIOGRAPHY

ADWR. (2010, September). *Assessments.* Retrieved September 2010, from Arizona Department of Water Resources, Water Management Division: http://www.azwater.gov/AzDWR/WaterManagement/Assessments/default.htm

ADWR. (2010). *DRAFT Arizona Water Atlas: Active Management Area Planning Area* (Vol. 8). Phoenix, AZ: Arizona Department of Water Resources.

ADWR. (1999). *Third Management Plan for Prescott Active Management Area.* Phoenix, Arizona: Arizona Department of Water Resources.

ADWR. (2003). *Third Management Plan for Prescott Active Management Area* (1st Modification ed.). Phoenix, Arizona: Arizona Department of Water Resources.

Arizona State University. (2009). Planning Integrated Research for Decision Support for Climate Adaptation and Water Management: A Focus on Desert and Coastal Cities. (pp. 10,11). Tempe, Arizona: Arizona State University.

Gookin, W. a. (1977). *Comprehensive Water Study of the City of Prescott and Environs.*

Inter Tribal Council of Arizona, Inc. (2003). *Yavapai-Prescott Indian Tribe*. Retrieved August 18, 2009, from Inter Tribal Council of Arizona, Inc.: http://www.itcaonline.com/tribes_yavapai.html

Intergovernmental Panel on Climate Change. (2007). *Climate Change 2007: The Physical Science Basis: Summary for Policymakers Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change.*

Jacobs, K. L. (2009, November). Personal Communication.

Nelson, K. (2010). ADWR Hydrologist. (G. Wildeman, Interviewer)

Nelson, K. (2002). Application of the Prescott Active Management Area Groundwater Flow Model Planning Scenario 1999-2025. *Modeling Report No. 12* .

Nelson, K. L. (2002). Prescott_Canal.xls. Phoenix, Arizona.

Northern Arizona University. (n.d.). *Yavapai-Prescott Indian Reservation*. Retrieved August 18, 2009, from Center for American Inidan Economic Development: http://www.cba.nau.edu/caied/TribePages/YavapaiPrescott.asp

Seagar, R., & Ting, M. e. (2007). Model Projections of an Imminent Transistion fo a More Arid Climate in Southwestern North America. *Science* , 1181-1184.

Sustainability of semi-Arid Hydrology and Riparian Areas. (2009, November 1). *Scenario Development*. Retrieved November 30, 2009, from SAHRA-Ensuring Water in a Changing World: http://www.sahra.arizona.edu/scenarios/

Timmons. (2006). *Prescott AMA Groundwater Flow Model Update Report.* Phoenix: ADWR.

U.S. Census Burea. (2000). *Detailed Tables - American FactFinder*. Retrieved January 2010, from http://factfinder.census.gov/servlet/DTTable?_bm=y&-context=dt&-ds_name=DEC_2000_SF1_U&-CHECK_SEARCH_RESULTS=N&-CONTEXT=dt&-mt_name=DEC_2000_SF1_U_P001&-mt_name=DEC_2000_SF1_U_P003&-tree_id=4001&-redoLog=false&-transpose=N&-all_geo_types=Y&-_caller=geosel

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APPENDICES

Appendix 1 Assumptions Used for Large Municipal Providers

Category	Scenario
Demand	**SCENARIO ONE**: The Department of Commerce population projection was used. The same large provider projection that was used in the likely scenario was used for the minimum scenario. The minimum population for each large provider x the TMP conservation requirement for each provider equals large provider demand.
	SCENARIO TWO: The undesignated large provider population projection used statistical trend lines, and the demand was calculated by multiplying by the 2000-2006 average GPCD for the provider. The designated large provider population and demand projection were from the provider's designation.
	SCENARIO THREE: The 2000-2006 average number of people added to the AMA each year was used to develop an overall AMA population. Then the percent difference between the AMA total maximum and the AMA total likely projection was multiplied by each large provider's projected population in the likely scenario to result in a maximum population for each provider. The maximum population for each provider x the 2000-2006 average GPCD or DAWS GPCD for each provider equals large provider demand.
Supply	Individual assumptions were made for each provider based on the designation of assured water supply for designated providers, and historic use of supplies for undesignated providers, capped based on treatment capacity. Sources include groundwater, reclaimed water direct used and recovered, and surface water recovered.

Appendix 2 Assumptions Used for Small Municipal Providers

Category	Scenario
Demand	**SCENARIO ONE:** The 1985-1999 average growth rate was used to project small provider population (same as the likely scenario). The Minimum small provider population projection x 1985-2006 average GPCD for small providers equals small provider demand.
	SCENARIO TWO: The 1985-1999 average growth rate was used to project small provider population. The projected population x 2000-2006 average GPCD for small providers equals small provider demand.
	SCENARIO THREE: The 2000-2006 average number of people added to the AMA each year was used to develop an overall AMA population. Then the percent difference between the AMA total Maximum and the AMA total Likely projection was multiplied by the small provider projected population in the likely scenario to result in a Maximum small provider population projection. The Maximum small provider population x the 2000-2006 average GPCD for small providers equals small provider demand.
Supply	100% groundwater

Appendix 3 Assumptions Used for Exempt Well Users

Category	Scenario
Demand	**SCENARIO ONE**: Exempt well population is the remainder of the Department of Commerce total AMA population after large provider and small provider projections are subtracted from it. The exempt well population, the TMP single family models for new development, and the 2000 Census average persons per household for Yavapai County were used to calculate projected exempt well demand for each year, 2007-2025.
	SCENARIO TWO: The 1985-1999 average growth rate was used to project exempt well population forward from the 2000 exempt well population. The exempt well population, the TMP single family models for new development, and the 2000 Census average persons per household for Yavapai County were used to calculate projected exempt well demand for each year, 2007-2025.
	SCENARIO THREE: The 2000-2006 average number of people added to the AMA each year was used to develop an overall AMA population. Then the percent difference between the AMA total Maximum and the AMA total Likely projection was multiplied by exempt well projected population in the Likely scenario to result in a Maximum exempt well population projection. The exempt well population, the TMP single family models for new development, and the 2000 Census average persons per household for Yavapai County were used to calculate projected exempt well demand for each year, 2007-2025.
Supply	100% groundwater

Appendix 4 Assumptions Used for Industrial Demand and Supply Projections

User Category		Scenario
Turf	DEMAND	**SCENARIO ONE:** Held current use constant through time
		SCENARIO TWO: Used AMA staff projections (current use plus one additional golf course)
		SCENARIO THREE: Used linear trend line
	SUPPLY	Assumed that industrial demand would be served by the same supplies in the same general proportion as in 2006
Sand & Gravel	DEMAND	**SCENARIO ONE:** Historical average plus an additional 200 acre-feet starting in 2008
		SCENARIO TWO: Historical average plus an additional 200 acre-feet starting in 2008
		SCENARIO THREE: Historical average plus an additional 200 acre-feet starting in 2008
	SUPPLY	Assumed that industrial demand would be served by the same supplies in the same general proportion as in 2006
Other	DEMAND	**SCENARIO ONE:** Historical average held constant through time
		SCENARIO TWO: Historical average held constant through time
		SCENARIO THREE: Linear trend line
	SUPPLY	Assumed that industrial demand would be served by the same supplies in the same general proportion as in 2006

Appendix 5 Assumptions Used for Non-Indian Agricultural Projections

	Category	Scenario	Assumption
Demand Factors	Maximum GW Allotment (>10 acres)	**ONE**	Proportional to acres based on 2006 allotments/acre.
		TWO	Begin with 2006 acres, with reductions based on AMA staff review and assumptions based on individual IGFRs. Not used to calculate demand; only provided as a reference.
		THREE	Held the same as 2006.
Demand	IGFRs > 10 AC	**ONE**	Semi log trend vs. time based on use between 2000-2006
		TWO	Begin with 2006 use, with reductions based on AMA staff review and assumptions based on individual IGFRs.
		THREE	Held the same as 2006.
	IGFRs < 10 AC	**ONE**	2000-2006 average use minus 1 standard deviation
		TWO	2000-2006 average use
		THREE	Held the same as 2006.
	Exception Users	**ONE**	AMA Staff review and assumptions.
		TWO	AMA Staff review and assumptions.
		THREE	Held the same as 2006.
	Canal & other losses	**ALL**	No canal losses since CVID switched from surface water to recovered reclaimed water.
Supply	Groundwater	**ALL**	Demand not met by other sources.
	Recovered Reclaimed Water	**ONE**	Exception Users demand is expected to be met by CVID recovered reclaimed water.
		TWO	Exception Users demand is expected to be met by CVID recovered reclaimed water.
		THREE	Held the same as 2006.
Incidental Recharge	Total	**ALL**	35% of total demand not including canal losses, plus 50% of canal losses.

Appendix 6 Assumptions Used for Recharge Projections

Storer	Permit Type	Facility Type	Source	Assumption
Municipal	USF	Constructed	Surface Water	Assumptions were made for each large provider for surface water availability and surface water stored based on historic information and current permitted underground storage facilities for surface water.
			Reclaimed Water	Assumptions were made for each large provider for surface water availability and surface water stored based on historic information and current permitted underground storage facilities for surface water.